NUCLEAR SCIENCE ABSTRACTS

Volume 32 Number 8

Abstracts 19235-21811

October 31, 1975

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Volume 32, Number 8, October 31, 1975

NUCLEAR SCIENCE ABSTRACTS

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Published by the ERDA Technical Information Center

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Comprehensive indexes appear in each issue and are cumulated at the end of each volume. The report number indexes will be cumulated on both a volume and two-volume basis. Multivolume cumulations have been issued as indicated above.

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Personal Authors

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

HOLLOWAY, J.A., Survey of image processing methods for radiography, 31:16451
HOLLWEG, J.V., Hydromagnetic waves in interplanetary space, 31:17953
HOLMBERG, E.B., Distribution of clusters of galaxies as related to galactic absorption, 31:16040
HOLMES, J.J., See BATES, J.F., 31:17444

Subjects

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

Examples:

NUCLEAR POWER PLANTS/REACTOR LICENSING
Experience acquired in the design and construction of operating plants (German Federal Republic), 31:19104
NUCLEAR POWER PLANTS/REACTOR SAFETY
Conception of radiation safety in atomic electric power plants, 31:15032 (CONF-701074-P1)
NUCLEAR POWER PLANTS/SITE SELECTION
Safety-related site parameters for nuclear power plants, 31:19052 (WASH-1361)
Status and development of nuclear power in the Federal Republic of Germany, 31:19105
NUCLEAR PROPERTIES/RESEARCH PROGRAMS
Accelerator physics group progress report, July--December 1973 (Research summaries), 31:18544 (INS-R-139)

Corporates

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

17606 (ANL/HEP-7440, pp I.1-I.12) ACCELERATED POLARIZED PROTONS AT THE ZGS. Ratner, L. G. (Argonne National Lab., Ill). Feb 1974.
From symposium on high energy physics with polarized beams; Argonne, Illinois, USA (8 Feb 1974).
In symposium on high-energy physics with polarized beams.

is indexed as:

ARGONNE NATIONAL LAB., ILL. (USA)
Accelerated polarized protons at the ZGS, 31:17606 (ANL/HEP-7440)
Acceleration of polarized protons in synchrotrons, 31:17692 (ANL/HEP-7440)
Analysis of population, birth, and death statistics in the counties surrounding the Big Rock Point Nuclear Power Station, Charlevoix County, Michigan, 31:16552 (ANL-8149)
Argonne polarized target facilities, 31:17762 (ANL/HEP-7440)
Calculation of transient fission-gas release from oxide fuels, 31:19031 (ANL-8143)

Report Numbers

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XDC-		
60-3-60	31:18403	Dep. NTIS, $7.25
XN-	**(Non-ERDA)**	
74-31(Rev.1)	31:19054	
209(Suppl.4) (Rev.1)	31:18750	Exxon, Richland, WA
Y-		
1966	31:19188	Dep. NTIS, $4.00

AVAILABILITY OF PUBLICATIONS ABSTRACTED

Public availability of all U. S. Energy Research and Development Administration reports is indicated in the report number indexes. The availability of other reports, when known, is also indicated. The availability of some unnumbered reports is given in the abstract.

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Information on the availability of the published literature and unpublished conference papers abstracted in *Nuclear Science Abstracts* can be obtained from the USERDA Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

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The Administrator of the Energy Research and Development Administration has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 30, 1978.

Volume 32, Number 8 October 31, 1975

NUCLEAR SCIENCE ABSTRACTS

CHEMISTRY

Analytical and Separations Chemistry

Refer also to abstracts 19779, 20265, 20374, and 21806.

Activation and Nuclear Reaction Procedures

Refer also to abstracts 19704, 19822, and 19824.

19235 (ANL-8153, pp 57-59) GEO- AND COSMOCHEMISTRY AND ARCHAEOLOGY. Jan 1975.

In Chemistry Division annual report, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

Lunar samples were analyzed by fast-neutron, slow-neutron, and photon-activation for F, Cl, Br, I, U, Li, Te, Hg, Ru, Os, ^{204}Pb, Bi, Tl, and Zn. In mineralogical studies, the distribution of U, Th, Ba, and the rare earths in the calcium–aluminium-rich inclusions in the Allende meteorite was studied by analyzing 15 Allende inclusions using neutron activation methods. (LK)

19236 (HEDL-TME-72-90, pp ANC.20-ANC.24) ACTIVITIES OF RADIOCHEMISTRY FOILS. Helmer, R. G.; Greenwood, R. C. Jun 1972.

In LMFBR reaction rate and dosimetry 4th quarterly progress report, March, April, May 1972. (Hanford Engineering Development Lab., Richland, Wash. (USA)).

19237 (JUL-1170) DETERMINATION OF VANADIUM, CHROMIUM, MANGANESE, AND ARSENIC IN TITANIUM OXIDE BY NEUTRON ACTIVATION ANALYSIS. Erdtmann, G.; Aboulwafa, O. (Kernforschungszentrum Karlsruhe (F. R. Germany)). Feb 1975. 61p. (In German). Dep. NTIS (US Sales Only) $6.25.

For the determination of vanadium, chromium, manganese and arsenic in titanium dioxide several different neutron activation analysis procedures were employed. Vanadium was determined via ^{52}V after a short-time irradiation of the hydrofluoric acid solution of titanium dioxide and extraction by N-benzoyl-N-phenylhydroxylamin. For analysis of chromium the sample is dissolved in potassium disulfate, chromium is extracted and determined by γ measurement of ^{51}Cr. Manganese can be measured by a γ spectrometer after reactor irradiation without chemical separation. Arsenic has to be carefully separated, above all from antimony which is usually present in a large excess. This has be done by a newly developed column extraction procedure, so that ^{76}As can be measured without interference. The development of the procedures and the completion of the analyses are fully described. (auth)

19238 (LA-UR-75-1331) NEUTRON MEASUREMENTS OF ^{234}U ISOTOPIC ABUNDANCE IN UF_6 SAMPLES. Stieff, L. R.; Walton, R. B.; Reilly, T. D.; Fields, L. W.; Walker, R. L.; Mullins, W. T.; Thoms, J. I. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-eng-36. 16p. (CONF-750608-11). Dep. NTIS $4.00.

From annual meeting of the Institute of Nuclear Materials Management; New Orleans, Louisiana, USA (18 Jun 1975).

Neutrons produced from the (alpha,n) reaction on fluorine were used to measure the ^{234}U isotopic abundance in UF_6 samples. A 4 PI detector consisting of 14 ^{3}He counters embedded in a polyethylene anulus was specifically designed to receive standard 1S (high-enriched) and 2S (low-enriched) UF_6 sample cylinders. The ^{234}U isotopic abundances of the 19 2S and 5 1S samples studied range from 0.30 to 4.0 percent (wt) and 80.0 to 97.7 percent (wt) respectively. A typical net weight for the UF_6 in the 1S cylinders is 800 g and in 2S cylinders is 1700 g. For counting times of 10^3 sec and for ^{234}U concentrations over a range of 0.001 to 1.0 percent (wt), the neutron method will achieve accuracies better than 2.5 percent (1 sigma) for the depleted and low-enriched UF_6 and approximately 0.5 percent (1 sigma) for the high-enriched UF_6 when compared with the ^{234}U isotopic abundances obtained using a high precision, two-stage mass spectrometer. Extension of the ^{234}U neutron assay method to samples containing ^{232}U is now being investigated. From these preliminary results it appears that the isotope separation plant operator and the safeguards inspector should be able to use this new nondestructive assay technique for precision measurements of the isotopic abundance of ^{234}U. In addition, the method could be useful as an indirect field method for ^{235}U assay where gamma techniques give inconclusive results and where the ^{235}U/^{234}U ratio can be assumed or has been previously established either by measurement or calculation. (auth)

19239 (NIM-1725) DETERMINATION OF SILICA IN FLUORSPAR BY 14 MeV NEUTRON-ACTIVATION ANALYSIS. Pearton, D. C. G.; Eddy, B. T.; Bibby, D. M. (National Inst. for Metallurgy, Johannesburg (South Africa)). 10 Jun 1975. 9p. Dep. NTIS (US Sales Only) $4.00.

Silica was determined in fluorspar (fluorite) down to a content of 0.3%, with a coefficient of variation of 11%. The coefficient of variation for a sample of 100% silica, which was used for calibration purposes, was 0.70%. This high level of precision was attained with a new sample-packing procedure, and the use of analogue stabilizers in the detection system. Iron, magnesium, and aluminium give rise to small interferences in the determination, and corrections for these interferences was determined. Phosphorus is a major source of interference since it readily produces the same radioisotope as does silicon; a correction must therefore be made, based on the phosphorus content. Results obtained on standard samples of fluorspar agree well with the recommended values, the precision of determination being 1% relative for concentrations greater than 10%. (auth)

19240 (NP-20480(P8), pp 106-107) CHARGED-PARTICLE ACTIVATION ANALYSIS. Nozaki, T.; Iwamoto, M.; Yatsurugi, Y.; Akiyama, N. Dec 1974.

In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

19241 SPECIAL FEATURES OF NEUTRON-ACTIVATION PROCEDURE FOR THE TRIPLE FERRITE SYSTEM $MnFe_2O_4$–$MgFe_2O_4$–$ZnFe_2O_4$. Lobanov, E. M.; Firei, E. I. (Inst. of Solid State Physics and Semiconductors, Minsk). Dokl. Akad. Nauk BSSR; 19: No. 4, 309-312(Apr 1975). (In Russian).

The best radioisotopes for analytical use in the precise determination of ferrites of the ternary system $MnFe_2O_4$–$MgFe_2O_4$–$ZnFe_2O_4$ were determined by experiment and by calculation to be ^{24}Na for magnesium, ^{56}Mn for manganese, ^{69m}Zn for zinc, and ^{59}Fe for iron. It was shown that for ^{24}Na, ^{56}Mn, and ^{69m}Zn it is possible to use both semiconductor and scintillation detectors. The scatter of the results obtained with the two types of detector did not exceed 1%. Iron was determined better with the semiconductor gamma spectrometer. Zinc may be determined with high precision also by coincidence of annihilation of gamma quanta on a coincidence spectrometer. (tr-auth)

19242 ELEMENTAL COMPOSITION OF AEROSOL PARTICLES IN RELATION TO THEIR SIZE. Mizohata, A.; Mat-

sunami, T.; Mamuro, T. Annu. Rep. Radiat. Center Osaka Prefect.; 15: 1-9(1974).

Instrumental neutron activation analysis was applied to size-separated aerosol samples collected by an Andersen air sampler and 32 elements were determined. The analytical data were treated by numerical analysis and the cumulative frequency and the size distribution were determined for each element. It was concluded that the elements analyzed were classified into three groups according to the positions of occurrence of the peak values in the size distribution curve. In the first group only one conspicuous peak appeared in a size range below 1 μ, in the second group only one peak appeared at about 3 μ, and in the third group two peaks appeared both in a range below 1 μ and at about 3 μ. (auth)

19243 COMPARATIVE TESTS OF AEROSOL SAMPLERS. Mamuro, T.; Matsunami, T.; Matsuda, Y.; Mizohata, A. Annu. Rep. Radiat. Center Osaka Prefect.; 15: 10-17(1974).

Airborne dusts were collected at eight different stations simultaneously with two types of air samplers, one was so-called "10 μ cut" sampler and the other an ordinary one, each with a membrane filter of 47 mm in diameter. The collected air samples were subjected to nondestructive multielement analyses by means of instrumental neutron activation analysis and energy dispersive x-ray fluorescence analysis. On the basis of the analytical data, the two types of samplers were compared with each other, as regards the collection property and the uniformity of the obtained air samples. Samples collected by "10 μ cut" samplers were found unexpectedly nonuniform, but this can be improved by a simple alteration. (auth)

19244 PHOTONEUTRON METHOD OF DETERMINING BERYLLIUM IN LUMP ORES. Tatarnikov, A. P.; Glazkov, A. S. Ind. Lab.; 40: No. 12, 1798-1799(Dec 1974).

Translated from Zavod. Lab.; 40: No. 12, 1496-1497(Dec 1975).

Samples are distinguished in terms of mass, form, dimensions, and in terms of the distribution of the useful component in the limits of the ore specimens. The γ source is placed under the specimen and neutron detectors at the side. The error for a unit determination with a concentration of BeO of less than 0.1% does not exceed 25 to 40%, and with concentrations above 1% it is 5 to 10%. (MCG)

19245 NON-DESTRUCTIVE DETERMINATION OF TUNGSTEN IN MOLYBDENUM BY NEUTRON ACTIVATION ANALYSIS, FROM MULTIPLE γ- AND X-RAY PEAK RATIOS. Lavi, N. (Soreq Nuclear Research Centre, Yavne, Israel). Anal. Chim. Acta; 74: No. 2, 269-274(Feb 1975).

Neutron activation analysis followed by high-resolution γ- and x-ray spectrometry was applied to the determination of trace amounts of tungsten in molybdenum metal. The method is based on measurements of multiple γ and x-ray peak ratios of ^{187}W activity. These peaks are used to calculate the amounts of tungsten in the sample, by the standard comparison technique. The tungsten concentration in molybdenum metal was found to be 0.199 ± 0.004%. (NL)

19246 DETECTION OF BORON COMPOUNDS ON CHROMATOGRAMS BY (n,α) NUCLEAR REACTION WITH THERMAL NEUTRONS. Kvitek, J. (Czechoslovak Academy of Sciences, Rez); Maleckova, M.; Base, K.; Plesek, J.; Hermanek, S. J. Chromatogr.; 103: No. 2, 385-389(Jan 1975).

The α-particles, created in the (n,α) nuclear reaction were formerly used for the evaluation of the boron content in different materials. The short range of α-particles in the sample materials, however, permits only the particles emitted from the surface to be detected. A homogeneous distribution of the boron compound through the whole depth of the sample is therefore a necessary condition for the accurate determination of the boron content in thick layers. If this condition is met, a surface concentration mapping of boron content is possible. The above method was applied to thin-layer chromatography, representing the first general method for the detection of boron compounds and the quantitative determination of boron content in separated spots. Silufol sheets (Kavalier, Votice, Czechoslovakia), i.e., pre-coated silica gel starch-bound layers (25 μm) on aluminium foil (100 μm), were found to be the best material for the separation of all types of boron compounds. (NL)

19247 EXPERIENCE WITH THE METHOD OF AUTORADIOGRAPHY FOR FIRING DISTANCE DETERMINATION. Schmitz, J. (Kernforschungszentrum Karlsruhe (F. R. Germany). Lab. fuer Isotopentechnik). Kriminalistik; No. 5, 207-210(1973). (In German).

6 figs.; 8 refs.

A method is described to determine firing distance with the aid of autoradiography following neutron activation. Especially in the range beyond 60 cm, which gives some difficulties in the quantitative analysis of Pb, Ba and Sb, autoradiography of the entrance vicinity gives a good reproducible comparison method and contaminations can be easily identified. The analysis is done with the long lived ^{124}Sb, which makes this method practicable for nonspecialists. This does not exclude the parallel quantitative Sb analysis of the bullet hole vicinity either by direct counting or photometry of the autoradiographs. Irradiation techniques, film material, exposure time and development descriptions will be discussed as well as aspects of practical application of this method. (auth)

19248 OPTIMAL SAMPLE DIMENSIONS FOR GAMMA ACTIVATION ANALYSIS. Kapitsa, S. P.; Martynov, Yu. T.; Samosyuk, V. N.; Sulin, V. V.; Tsipenyuk, Yu. M. Sov. At. Energy (Engl. Transl.); 37: No. 4, 1100-1102(Oct 1974).

Translated from At. Energ. (USSR); 37: No. 4, 356-357(Oct 1974).

Samples are usually irradiated with bremsstrahlung (10-20 MeV max) and the induced activity (0.1-1 MeV) measured with a single-crystal scintillation spectrometer. For efficient use of the primary and secondary γ rays, the sample dimensions should be adjusted so that the dimension along the bremsstrahlung axis is the length over which the bremsstrahlung intensity is reduced by a factor e, and the radial dimension at right angles is the thickness over which the γ-ray intensity is attenuated by the factor e. Gold-containing samples of varying size are used to confirm these assertions. (DLC)

19249 DETERMINATION OF CHLORINE AND BROMINE IN POTATO BY NEUTRON ACTIVATION ANALYSIS. Maruyama, Y.; Manri, T. (Musashi Inst. of Tech., Kawasaki, Kanagawa (Japan). Atomic Research Lab.). Radioisotopes (Tokyo); 23: No. 11, 609-613(Nov 1974).

The extractability of the nuclides ^{38}Cl and ^{82}Br from the irradiated potatoes was investigated using the extractants such as water, sodium hydroxide solution and nitric acid. The irradiated samples were extracted by shaking for 2 min with the extractans. The extraction yields of ^{38}Cl and ^{82}Br increased with the elevation of temperature and with the addition of carriers. Among the extractant used, nitric acid was found to be the most effective for the extraction of ^{38}Cl and ^{82}Br. When extractions were performed at 90°C with nitric acid containing carriers, almost 100% of these nuclides were found to be extractable. These experimental results were utilized for the activation analysis of chlorine and bromine in potato. It was found that chlorine and bromine tended to be concentrated in stem, leaf and tuber in the decreasing order. (JA)

19250 NEUTRON ACTIVATION ANALYSIS OF TRACE ELEMENTS IN WATER SAMPLE. Nagatsuka, S.; Tanizaki, Y.; Okano, Y. (Tokyo Metropolitan Isotope Research Center (Japan)). Radioisotopes (Tokyo); 23: No. 12, 693-699(Dec 1974). (In Japanese).

A method of preconcentration necessary for the activation analysis of trace elements in water samples and its application is described. As it is difficult to determine volatile elements and short-lived nuclides by the instrumental neutron activation analysis using the evaporation residue of water samples, the preconcentration by coprecipitation with $Fe(OH)_3$, $Al(OH)_3$ and PbS was tried for the analysis of these elements. The recovery of these elements was examined in advance by means of radioactive tracer. It was found convenient that the precipitation is made from a solution of pH 6 in the $Fe(OH)_3$ or $Al(OH)_3$ coprecipitation or from a weakly acid solution in the PbS coprecipitation. Gamma spectrometry by a coaxial Ge(Li) detector connected to a 4096 channel PHA was performed on the irradiated sample without any further chemical separation. This preconcentration method was applied to the river water sample taken from a comparatively clean river in Okutama district in the Tokyo Metropolis. About 30 elements in it were thus determined. (JA)

19251 METHOD OF ANALYZING METALLIC COMPOSITION IN PARTICULATE SUBSTANCES SUSPENDING IN ATMOSPHERE. Oikawa, K. (Japan Environmental Sanitation Center, Kawasaki, Kanagawa); Hashimoto, Y.; Yanagisawa, S. Bunko Kenkyu; 23: No. 3, 111-127(Jun 1974). (In Japanese).

Methods of collecting and analyzing atmospheric particle substances are reviewed. Samplers, suction equipments, and flow meters are comparatively studied. Filter materials and their impurities as well as filtration efficiency are also studied. Emission spectrum analysis, atomic absorption analysis, neutron activation analysis, and x-ray fluorescence analysis are discussed. There is no suction equipment that can simultaneously satisfy all conditions, namely high vacuum, large flow rate, non-pulsation, easy carrying, etc. Rotary compressors and blower motors are used generally. As for flow meters, rotameters and gas meters

are used commonly. Glass fiber filter material can be used for the analysis by emission spectra and atomic absorption, but cannot be used for neutron activation analysis and x-ray fluorescence analysis. Whatman 41 filter paper showed the best result in the impurity test of filters other than glass fiber. The importance of the atomic absorption analysis will remain. The role of the neutron activation analysis and x-ray fluorescence analysis in the monitoring of air pollution will increase in future. (JA)

Chemical and Spectral Procedures

Refer also to abstracts 19377, 19533, 19823, 20251, 20252, 20270, and 21510.

19252 (GERHTR-102) IDENTIFICATION OF PYROLYSIS BY-PRODUCTS IN FLUIDIZED BED SOOT AND PYROCARBON. Wolfrum, E.; Rottmann, J.; Nickel, H. Translated from Z. Anal. Chem.; 268: 19-25(1974). 17p. Dep. NTIS $4.00.

From conference on trace analysis; Erlangen, Ger. (2 Apr 1973).

In the context of development of improved fuel particles for high-temperature reactors, a study was made in relation to the pyrolysis by-products of the pyrocarbon deposited on fuel kernels in the fluidized beds and of the soot produced during the pyrolysis process. This study was made of the mechanism of pyrocarbon deposition on fuel kernels during the thermal decomposition of lower hydrocarbons. Pyrolysis products of acetylene and propene were studied. The extracts were analysed by mass spectrometry and also separated by a combination of gas chromatography and mass spectrometry. 21 polycyclic, aromatic hydrocarbons could be identified in the soot. Polycyclic hydrocarbons of even higher molecular weights were also contained in the pyrocarbon. (auth)

19253 (LA-tr-75-26) SPECTROPHOTOMETRIC DETERMINATION OF URANIUM (VI) BY EXTRACTION OF URANIUM (VI)-ARSENAZO III COMPLEX WITH QUATERNARY AMMONIUM CHLORIDE. Fukamachi, K.; Kohara, H.; Ishibashi, N. Translated from Jap. Anal.; 21: 1165-1169(1972). 9p. Dep. NTIS $4.00.

The extraction of uranium (VI)-Arsenazo III complex with high molecular weight ammonium salt has been investigated in order to increase the sensitivity and selectivity of the spectrophotometric determination of uranium (VI) with Arsenazo III. Arsenazo III and its uranium (VI) complex are extracted into various organic solvents in the presence of high molecular weight ammonium chloride. Uranium (VI) complex extracted into chloroform with dodecyl-octyl-methyl-benzylammonium chloride has an absorption maximum at 655 mμ, and the absorbance is constant in the pH range from 0.8 to 1.2. Molar absorptivity of the complex is found to be 5.6×10^4, and the molar ratio of uranium (VI) to Arsenazo III in the complex in the organic phase is estimated to be 1 to 1. The recommended procedures are as follows. A sample containing 0 ~ 30 μg of uranium (VI) was taken in 50 ml extractive tube (20φ × 250 mm test tube with a ground stopper), and 2.0 ml of 1.0×10^{-2} M EDTA solution was added and then the pH of the solution was adjusted to 0.8 to 1.2 by addition of hydrochloric acid or sodium hydroxide. After 3.00 ml of 5.0×10^{-4} M Arsenazo III solution was added, 10.0 ml of 5% dodecyl-octyl-methyl-benzylammonium chloride-chloroform solution was added and the solution was shaken for about ten minutes. The absorbance of the chloroform layer was measured at 655 mμ against the reagent blank. Beer's law is obeyed at least up to 1.2×10^{-5} M uranium (VI) in chloroform solution. The presence of manganese (II), nickel (II), copper (II), zinc (II), cadmium (II), aluminum (III), chromium (III), iron (III), zirconium (IV), vanadium (V) and tungsten (VI) causes no disturbance of the determination of uranium (VI), but thorium (IV) is extracted like the uranium (VI) complex and interferes the determination. The sensitivity of this method is twice as much as that of extraction method using diphenylguanidium chloride-butanol solution. (auth)

19254 USE OF INDIRECT POLAROGRAPHY FOR ANALYZING MULTIPLY ALLOYED STEELS AND WASTE PRODUCTS FROM ZIRCONIUM PRODUCTION. Sevryukov, N. N.; Dorofeeva, G. I.; Kutruza, N.; Kamus, K. (Peoples' Friendship Univ., Moscow). Ind. Lab.; 40: No. 12, 1732-1734(Dec 1974).

Translated from Zavod. Lab.; 40: No. 12, 1444-1446(Dec 1975).

The polarographic determination of the indium displaced from InY^- by zirconium was used to analyze the zirconium. Experiments carried out with synthetic solutions demonstrated good accuracy and reproducibility for the determination of up to 1×10^{-4} to 1×10^{-3} M zirconium in the presence of 100-fold quantities of Fe^{3+}, Al^{3+}, Cr^{3+}, Y^{3+}, and Ti^{4+}. (LK)

19255 LUMINESCENCE METHOD FOR DETERMINATION OF GADOLINIUM IN YTTRIUM OXIDE. Zhikareva, E. A.; Zelyukova, Yu. V.; Poluektov, N. S. (Inst. of General and Inorganic Chemistry, Odessa). Ind. Lab.; 40: No. 12, 1721-1723 (Dec 1974).

Translated from Zavod. Lab.; 40: No. 12, 1434-1437(Dec 1975).

The possibility of using x-ray excitation to determine gadolinium impurity in yttrium oxide, using phosphor crystals based on yttrium oxyfluoride, was investigated. The results from the analysis of several samples of yttrium oxide are given. The sensitivity of the method is 3×10^{-4}% Gd in Y_2O_3. (LK)

19256 SPECTROGRAPHIC ANALYSIS OF SCALE FROM Cr-Mo-V STEELS. Lapinskaya, M. E.; Kuznetsova, G. V.; Shitt, E. S. (Dzershinsk All-Union Inst. of Heat Tech., USSR). Ind. Lab.; 40: No. 12, 1775(Dec 1974).

Translated from Zavod. Lab.; 40: No. 12, 1478(Dec 1975).

Spectral analyses were made of oxide films produced on metals at high temperatures. The material was analyzed simultaneously for MoO_3, Cr_2O_3, U_3O_8, SiO_2, Al_2O_3, and MnO_2. The coefficient of variation was 7%. (LK)

19257 PHOTOMETRIC DETERMINATION OF CERIUM IN STEEL WITH ARSENAZO III REAGENT. Bukhtiarov, V. E. Ind. Lab.; 41: No. 1, 37(Jan 1975).

Translated from Zavod. Lab.; 41: No. 1, 31-32(Jan 1975).

The proposed method is based on the ability of arsenazo III to form a colored compound with cerium at pH 2.5-4. The absorption maximum of the compounds lies at 650 nm. Zirconium, bismuth, Cu(II), and more than 1 mg of titanium, aluminum, calcium, and iron(III) in 50 ml interfere with the determination. Chlorides, sulfates, and phosphates do not interfere. (LK)

19258 VOLUMETRIC DETERMINATION OF HALIDE IONS IN COLORED AND CLOUDY SOLUTIONS. Korenman, I. M.; Gorokhov, A. A.; Polozenko, G. N. (Gorky State Univ., USSR). Ind. Lab.; 41: No. 1, 34(Jan 1975).

Translated from Zavod. Lab.; 41: No. 1, 30(Jan 1975).

Analysis of cloudy and colored aqueous solutions and certain liquid organic media by the mercurimetric method for determination of halide ions is not possible. However, it was shown that an organic solvent and indication of the equivalence point by the change in the color of the organic layer can be used for the mercurimetric titration. A vanishingly small excess of mercury ions gives rise to the formation of a strongly colored chelate compound with the indicator. The compound is readily extracted by the organic solvent, giving it a violet color. The method was checked on standard solutions of alkali metal chlorides, bromides, and iodides. The smallest concentration of halide ions that can be determined is 0.3 mg/liter. (LK)

19259 ELECTRON MICROSCOPY 1974. Volume I. Physical. Proceedings of the Eighth International Congress on Electron Microscopy Held in Canberra, Australia, 25-31 August 1974. Sanders, J. V.; Goodchild, D. J. (eds.). Canberra, Australia; The Australian Academy of Science (1974). 774p. (In Several Languages). (CONF-740853-P1).

From 8th international congress on Electron Microscopy; Canberra, Australia (25 Aug 1974).

Abstracts of 360 papers presented at the conference are included in Volume 1. Titles of the individual sessions are: advances in electron microscopy technology; transmission microscope systems; scanning microscope systems; microprobe systems; recording and display systems; electron sources; lens design and construction; specimen stages, in-situ experiments; image formation and contrast; high resolution; contrast from defects; image reconstruction and correction; electron diffraction; energy analysis; specimen preparation (physical); small defects in metals; structure of minerals; images of crystal structure; ceramics; phase transformations; plastic deformation; grain boundaries; radiation damage (physical); magnetic effects and contrast; semiconductors and microcircuits; solid state precipitation surfaces; thin films, epitaxy; and other applications. (LK)

19260 SPECTROPHOTOMETRIC DETERMINATION OF MOLYBDENUM IN STEEL WITH THIOCYANATE AND TETRAPHENYLARSONIUM CHLORIDE. Fogg, A. G.; Kumar, J. L.; Burns, D. T. (Loughborough Univ. of Tech., Eng.). Analyst; 100: No. 1190, 311-315(May 1975).

An alternative procedure is described for the colorimetric determination of molybdenum in steel. Molybdenum(VI) is reduced to molybdenum(V) with ascorbic acid and titanium(III) before being caused to react with thiocyanate and extracting it with tetraphenylarsonium chloride into chloroform that contains quinol. The procedure is sensitive ($\epsilon_{max.} = 17\,400$ l mol^{-1} cm^{-1} at 470 nm) and precise. A forty-fold excess of tungsten over molybdenum can be tolerated. Results for a series of low-alloy and tungsten tool steels are reported. (auth)

19261 ELECTRIC DISCHARGE METHOD OF DETERMINING CARBON IN POWDERED ZIRCONIUM CARBIDE. Anisimova, Z. A.; Patrikeeva, N. A. (Voroshilovgrad Machine-building Inst.,

USSR). Zh. Anal. Khim.; 30: No. 5, 1005-1006(May 1975). (In Russian).

Relatively high carbon concentrations (8–14%) can be determined by the electric discharge method by using the argon atmosphere (which protects from oxidation processes), reduced pressure (which promotes observation of ionic and atomic spectral lines), and a hard excitation source (pulse discharge). (auth)

19262 POTENTIOMETRIC DETERMINATION OF DIFFERENT IODINE FORMS IN NATURAL WATER BY ION-SELECTIVE ELECTRODES. Zeinalova, E. A.; Morshina, T. N.; Senyavin, M. M. (Inst. of Geochemistry and Analytical Chemistry, Moscow). Zh. Anal. Khim.; 30: No. 5, 966-970(May 1975). (In Russian).

The effect of the valent states of iodine was experimentally studied on the accuracy and precision of potentiometric determination of iodide. Elemental iodine interferes with the iodide determination if the ratio $I_2/I^- > 10$. The effect of iodate ions is insignificant in neutral and alkaline solutions. In acid media, the iodate ion reduces the iodide ion to element iodine. The total contents of iodine in water can be determined if a reducing agent is added to the system. A procedure is suggested for determining iodides and the total iodine contents in natural water of different composition. (auth)

19263 DETERMINATION OF IODIDES IN SOIL BY KINETIC METHODS. Yasinskene, E. I.; Umbrazhyunaite, O. P. (Vilnyus State Univ., USSR). Zh. Anal. Khim.; 30: No. 5, 962-965(May 1975). (In Russian).

The reactions were examined of oxidizing catechol violet and bromopyrogallol red with chloroamine B catalyzed by iodides. Kinetic procedures were developed of determining iodides in soil with a sensitivity $1.3 \cdot 10^{-3}$ μg/ml. The procedure involving oxidizing bromopyrogallol red with chloroamine B proved to be more sensitive than such very procedure but involving the oxidation with H_2O_2. (auth)

19264 USE OF RUTHENIUM (IV) AS CATALYZER IN TITRIMETRY. VI. Potentiometric Determination of Cerium (IV) with Hydrazine. Norkus, P. K.; Yankauskus, Yu. Yu. (Vilnyus Engineering Construction Inst., USSR). Zh. Anal. Khim.; 30: No. 5, 625-628(May 1975). (In Russian).

The reaction between cerium (IV) and hydrazine in acid media was studied in the presence of catalyzers (osmium and ruthenium compounds) and in their absence. Conditions were elucidated for direct potentiometric titration of cerium (IV) with $N_2H_4 \cdot H_2SO_4$ solution using Ru(IV) as catalyzer. (auth)

19265 INCREASE IN THE SELECTIVITY OF PHOTOMETRIC DETERMINATION OF THE ALKALINE EARTH ELEMENTS IN AQUEOUS–ORGANIC MEDIA. Petrova, T. V.; Savvin, S. B.; Dzherayan, T. G. (Inst. of Geochemistry and Analytical Chemistry, Moscow). Zh. Anal. Khim.; 30: No. 5, 918-924(May 1975). (In Russian).

The possibility was shown of increasing the selectivity of photometric determination of the alkaline earth elements (AEE) with bis-azo substituted derivatives of chromotropic acid as reagents using color reactions in aqueous-organic media in the presence of masking agents. Sulfates, oxalates, fluorides, and EDTA were examined as masking agents. The selectivity of determing AEE is higher in aqueous-organic media than in aqueous ones. The determination of Ca in the presence of Cr, Ba, and their mixtures is possible based on masking their color reactions with sulfates in aqueous-acetone mixtures. The determination of Sr in the presence of Ca is possible when masking with oxalates in aqueous-propanol mixtures is used. (auth)

19266 ULTRAMICROMETHOD OF FLAME-SPECTROMETRIC DETERMINATION OF RUBIDIUM AND CESIUM TRACES. Shapkina, Yu. S.; Prudnikov, E. D. (Leningrad State Univ.). Zh. Anal. Khim.; 30: No. 5, 906-912(May 1975). (In Russian).

Conditions were studied for the pulse method of ultramicrodetermination of Rb and Cs from emission in flame. A procedure was worked out for determination of 10^{-4} to 10^{-5}% Rb_2O and Cs_2O in various materials using samples of less than 1 mg. (auth)

19267 ETHYL ETHER OF RHODAMINE B AS A REAGENT FOR EXTRACTION-PHOTOMETRIC DETERMINATION, EXTRACTION SEPARATION, AND GROUP EXTRACTION CONCENTRATION OF ELEMENTS. Bochkareva, I. A.; Blyum, I. A. (Inst. of Mineralogy, Geochemistry, and Crystallochemistry of Rare Elements, Sverdlovsk, USSR). Zh. Anal. Khim.; 30: No. 5, 874-882(May 1975). (In Russian).

The ability of ethyl ether of rhodamine B to react with 52 elements was examined in the H_2SO_4–$Br^-(Cl^-)$–benzene system. Conditions are recommended for extraction-absorptiometric determination of 9 elements Pt(IV), Ag(I), Hg(II), Cu(I), Sb(III), Au(III), Tl(I), Te(IV), and In(III) as associates of the bromide complexes with ethylrhodamine B. Some extraction, optical, and metrologic characteristics of each procedure are given. Differences in behavior of the associates simultaneously extracted were used to develop procedures of separation of the element to be determined (Tl, Hg, Cu) from accompanying elements. (auth)

19268 REACTION OF RARE EARTHS WITH ORTANIL K AND THEIR SPECTROSCOPIC DETERMINATION IN BINARY MIXTURES. Kirillov, A. I.; Shaulina, L. P.; Vlasov, N. A. (Irkutsk State Univ., USSR). Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.; 18: No. 4, 551-553(1975). (In Russian).

The color interaction of rare earth ions with ortanil K was studied, the optimum conditions for which are pH 4.0–4.5 and λ = 660–670 nm. The ratio of the components in the complex is Me:R = 1:2. Because of the dependence of the relative optical density of the solutions of the complexes on the order number of the rare earth, ortanil K can be recommended as a selective reagent for determination of La, Ce, Pr, and Nd in a mixture of Tm, Yb, Lu, and Y oxides. The molar absorption coefficients, the sensitivity of the reaction, and the concentration limits within which Beer's law applies were calculated. Lanthanum was determined in a binary mixture with thulium or yttrium. (tr-auth)

19269 THE EXTRACTION SPECTROPHOTOMETRIC DETERMINATION OF YTTRIUM WITH XYLENOL ORANGE AND ETHYLTRIDODECYLAMMONIUM BROMIDE. Shijo, Y. (Utsunomiya Univ. (Japan). Faculty of Engineering). Jap. Anal.; 23: No. 8, 884-889(Aug 1974). (In Japanese).

A method of spectrophotometric determination of yttrium subsequent to solvent extraction of the yttrium-Xylenol Orange (XO) chelate into xylene solution of ethyltridodecylammonium bromide (ETDA) was investigated. The yttrium-XO-ETDA complex can be extracted into such aromatic hydrocarbons as benzene, toluene and xylene, but not into such polar solvent as n-butanol, ethylacetate, methylisobutylketone and nitrobenzene. Beer's law is obeyed up to 4.5 μg yttrium per 5.0 ml of xylene. The molar absorptivity of the complex is 7.6×10^4 $cm^{-1}mol^{-1} \cdot l$ at 604 nm. Composition of the complex is estimated to be Y:XO:ETDA = 1:1:2. Vanadium, thorium, uranium, aluminum, zirconium, nitrate, perchlorate, citrate, and EDTA interfere seriously. (JA)

19270 DILUTION MASS ANALYSIS OF ISOTOPES BY UTILIZING STABLE ISOTOPES. Its Application to Nuclear Field. Komori, T.; Tamura, S. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Jap. Anal.; 23: No. 7, 804-810(Jul 1974). (In Japanese).

The latest advance and operational problems of spark ion source mass analysis are reviewed in the nuclear field. The necessary operation steps of isotope dilution method consist, as a rule, of dissolving a known amount of specimen, adding a predetermined amount of spike to this solution, mixing to uniformity, making chemical form so that the measurement of isotope ratio is possible, and finally enumerating the amount of specimen according to a derived equation. Spike calibration is necessary to prevent inaccuracy. Electron bombardment method and surface ionization method are employed to determine isotope ratio. The accuracy from 0.1% to 1% can be obtained by mass analysis for 1 to 100 isotope ratio. The sensitivity of this method is in the range from 10^{-6} to 10^{-12}g of a solid element. This method is suitable for the analysis of strong radioactive samples, samples containing other hardly separable element, standard sample, and gas composition. (JA)

19271 FLUORESCENCE REACTION OF BERYLLIUM WITH 5-HYDROXYFLAVONE, 5-HYDROXYISOFLAVONE AND THEIR DERIVATIVES. Murata, A.; Tominaga, M.; Suzuki, T. (Shizuoka Univ., Hamamatsu (Japan). Faculty of Engineering). Jap. Anal.; 23: No. 11, 1349-1355(Nov 1974). (In Japanese).

The effect of substituents on the fluorescence intensity of the beryllium complexes of 5-hydroxyflavone (2-phenyl derivative of 5-hydroxychromone), 5-hydroxyisoflavone (2-phenyl derivative of 5-hydroxychromone) and their derivatives is reported. All of the reagents form complexes with beryllium, which show the most intense and constant fluorescence when they are extracted from a solution of pH 8 to 10 into CCl_4. The introduction of an alkyl group ($CH_3 < C_2H_5$) into the 2-position of 5-hydroxyisoflavone increases the fluorescence intensity. Furthermore, the introduction of methoxyl group to the 7-position, accompanied by the shift of maximum excitation wave-length to a shorter wavelength, greatly increases the intensity excited at 366 nm. 2-Ethyl-5-hydroxy-7-methoxyisoflavone seems to be a suitable reagent for the fluorometric determination of beryllium. The recommended analytical procedure is: 5 ml of 1×10^{-3} M methanol solution of the reagent, and an additional 7.5 ml of methanol in order to give final concentration of 50 vol% methanol, together with 5 ml buffer solution (boric acid and sodium hydroxide, 0.25 M in borate, pH ca.9) are added to a beryllium solution, and the mixture is diluted to 25 ml with water. After about 30 min. the formed complex is extracted by shaking with 10 ml of CCl_4 for about one minute. The organic phase is dried over sodium sulfate, and its fluores-

cence intensity is measured with an excitation wavelength of 366 nm, using a secondary filter transparent for wavelength > 430 nm. Temperature changes, within the range of 10 to 25°C, have no effect on the intensity. The complex is stable for at least one hour. The calibration curve is linear in the range of about 0.01 to 0.3 μg of beryllium when an aqueous solution of 1 μg/ml fluoresein sodium salt is used as the reference standard. The effect of diverse ions was also examined. (auth)

19272 ATOMIC ABSORPTION SPECTROPHOTOMETRIC DETERMINATION OF RARE EARTHS (Y, Eu, Gd, Dy, Ho, AND Er) IN SINGLE CRYSTALS OF MAGNETIC GARNETS AND SULFIDES. Ametani, K. (RCA Research Lab. Inc., Tokyo (Japan)). Bull. Chem. Soc. Jap.; 47: No. 9, 2238-2241(Sep 1974).

Atomic absorption spectrophotometric studies were carried out on single-crystal rare-earth magnetic garnets, $(R_1,R_2)_3(Fe,Ga)_5O_{12}$, where R_1 and R_2 are Y, Eu, Gd, and Er, and sulfides RCr_3S_6, where R is Y, Gd, Dy, Ho, and Er. A method using lanthanum chloride to suppress the interference effects of other elements was demonstrated for the atomic-absorption determination of rare earths. Lanthanum chloride is much better than alkaline metal chlorides (NaCl, KCl, and CsCl) and chelating agents (EDTA·2Na and EDTA·$2NH_4$) for removing the interference effects of foreign elements from the yttrium measurement. Similar results with lanthanum chloride are observed with other rare earths. Experimental results for various samples are also presented. The present method has been utilized for several years in our laboratories to analyze rare earths in newly prepared materials. (auth)

Radiometric and Radiochemical Procedures

Refer also to abstracts 19365, 19689, 19690, 19714, 19716, 19722, 20250, and 20376.

19273 (COO-3040-4) DESIGN AND CONSTRUCTION OF A DETECTION SYSTEM FOR THE DETERMINATION OF LEAD IN BLOOD USING X-RAY FLUORESCENCE ANALYSIS. Progress Report, August 1, 1974–July 31, 1975. Laurer, G. R.; Kneip, T. J. (New York Univ., N. Y. (USA). Medical Center). 1975. Contract AT(11-1)-3040. 21p. Dep. NTIS $4.25.

Intercomparison difficulties between x-ray fluorescence (XRF) and atomic absorption (AA) measurements of blood lead were due to weight variations in the samples which are correlated to the hemoglobin content. Correction factors were developed to account for changes in background and sensitivity due to weight and hence hemoglobin content variations. Good agreement was achieved in comparisons of XRF and AA determinations on baboon blood, and a preliminary intercomparison with the New York City Health Department demonstrated that the corrected XRF values are accurate for children's blood. The XRF system can accurately determine blood lead concentrations in the range of 0.1 to 3.0 ppM. The difference in the content of zinc in the urine of two individuals undergoing chelation therapy was determined, using XRF analysis, on samples taken before and after treatment. The ratio of the count rate under the Zn K/sub alpha/ peak for one of these persons after treatment was 250 : 1, compared to before chelation. (auth)

19274 (IEA-369) INFLUENCE OF CONDUCTIVITY OF THIN GOLD FILMS ON PROPORTIONAL COUNTING. Moura, L. P.; Parker, W. C. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Jan 1975. 9p. Dep. NTIS (US Sales Only) $4.00.

In the absolute standardization of radionuclides by means of a 4π gas flow proportional counting, it is common practice to deposit the radioactive material on a thin foil of VYNS metalized with gold to render it a conducting surface. The detection efficiency as well as the pulse time formation distribution in function of the conductivity of these foils are reported. With these it was verified that the conductivity has a significant effect on the detector field configuration and the most convenient conductivity value that must be used was determined. (auth)

19275 LIQUID SCINTILLATION COUNTING: SOME QUESTIONS IN THE USE OF A MINIVIAL. Kiritani, R. Annu. Rep. Radiat. Center Osaka Prefect.; 15: 82-85(1974).

The measurement of radioactivity of a compound in a minivial instead of a regular vial is useful for reduction in the volume of the liquid waste. The optimum volume of the cocktail for the minivial was found to be 6 ml. This means that the use of the minivial results in approximately a three-fold reduction in the cocktail volume. For the measurement of specific activity by AES method, the simplest way, the calibration curve for the minivial was drawn. In the measurement of radioactivity in a minivial by IS method or by channel ratio method, it is not necessary to pay the special regard for the correction of the observed value. (auth)

19276 DETERMINATION OF PHOTOOXYGENATION PRODUCTS OF ROTENONE WITH ISOTOPE-DILUTION METHOD. Chubachi, M.; Hamada, M. Annu. Rep. Radiat. Center Osaka Prefect.; 15: 78-81(1974).

When rotenone dissolved in certain solvent was photochemically oxidized, rotenolones, dehydrorotenone, and rotenonone were obtained as main products. In order to determine the quantitative yields of these compounds in photooxygenation products, four compounds mentioned above were labeled with ^{14}C and the isotope dilution method by these labeled compounds was applied to the product analysis. (auth)

19277 SIMULTANEOUS ANALYSES OF GASEOUS AND PARTICULATE SULFUR COMPOUNDS IN THE ATMOSPHERE BY X-RAY FLUORESCENCE SPECTROMETRY. I. Matsuda, Y.; Mamuro, T. Annu. Rep. Radiat. Center Osaka Prefect.; 15: 18-23(1974).

An analytical technique for the simultaneous measurements of the atmospheric concentrations of SO_2 gas and sulfur absorbed by aerosol particles was developed. Aerosol particles are collected on membrane filter and at the same time SO_2 gas is captured on alkali impregnated filter. The sulfur content in each filter is measured by an energy dispersive x-ray fluorescence spectrometer consisting of a Si(Li) semiconductor detector connected to a multichannel pulse height analyzer and excitation source of ^{55}Fe. Two methods are acceptable for the determination of the sulfur content in impregnated filter by x-ray fluorescence analysis. In the first method x-ray fluorescence analysis is made after the collected sulfur has diffused and distributed uniformly enough throughout filter, and in the second method x-ray fluorescence analysis has to be finished before the diffusion of the collected sulfur becomes appreciable. (auth)

19278 CONTENTS OF URANIUM AND THORIUM SERIES NUCLIDES IN SOIL PARTICLES IN RELATION TO THEIR SIZES. Megumi, K.; Mamuro, T. Annu. Rep. Radiat. Center Osaka Prefect.; 15: 30-34(1974).

A sample of soil originating from the weathering of granite rock was sieved into ten size ranges, from below 1 μm up to 250 to 260 μm. The concentrations of uranium series nuclides (^{234}Th, ^{226}Ra and ^{210}Pb) and thorium series nuclides (^{228}Ac and ^{224}Ra) in each sieved soil sample were determined by γ-ray spectrometry using two Ge(Li) detectors, one being of planer type and another of coaxial type. The concentration of each nuclide in the soil sample smaller than 1 μm was found very high compared with that in the soil sample of 250–260 μm; the activity ratios of the former to the latter were 3.5 for ^{234}Th, 8 for ^{226}Ra, 5 for ^{210}Pb, 13 for ^{228}Ac and 20 for ^{224}Ra, respectively. In the soil sample smaller than 1 μm conspicuous disequilibrium was found among both the uranium and thorium series nuclides. Contrary to this, in the soil sample larger than 150 μm these nuclides were nearly in equilibrium with one another. (auth)

19279 SURFACE ANALYSIS, METHODS OF STUDYING THE OUTER ATOMIC LAYERS OF SOLIDS. Brongersma, H. H.; Meijer, F.; Werner, H. W. (Philips Gloeilampenfabrieken NV, Eindhoven, Netherlands). Philips Techn. T.; 34: No. 11, 357-369(Dec 1974).

Studies of the interaction of ions, electrons, and photons with a solid surface provides information about the composition of the surface and its structure on an atomic scale. Depending on the method used, the information may relate to the outer atomic layer or to a surface layer 1-5 nm thick. A qualitative, usually atomic, and in most cases a quantitative analysis can be made with ion-scattering experiments, secondary-ion mass spectrometry (SIMS), Auger electron spectroscopy, and ESCA (the study of electron emission during photon bombardment). Simultaneous sputtering of the surface by ion bombardment yields a concentration profile. Geometric information on an atomic scale is obtained from ion-scattering experiments and low-energy electron diffraction (LEED). Ellipsometry supplies information about the position of the electron energy levels at the surface; similar information is obtained from photoemission measurements. (INIS)

19280 DETERMINATION OF RADIOCHEMICAL PURITY OF RADIOCHROMATE SOLUTION BY THIN-LAYER CHROMATOGRAPHY. Ebihara, H.; Kamioki, H. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Jap. Anal.; 24: No. 1, 56-60(Jan 1975). (In Japanese).

A rapid and accurate TLC method for the determination of ^{51}Cr of non-chromate form in radiochromate solution was developed as a routine procedure for examination of radiochemical purity of the commercial radioactive sodium chromate in isotonic solution. Since a typical radiochemical impurity in the product was ^{51}Cr of reduced form, several combinations of the inorganic solutions and silica gel or alumina plates were attempted to find

out the best separation condition of the two species in comparison with the paper chromatography laid down in the Japanese pharmacopoeia. The counting of the radioactivity in the chromatograms was carried out with a well-type scintillation counter (Aloka, model JDC-701) by cutting the plate or paper in strips of 5 mm or 10 mm in width. Separation of Cr(VI) and Cr(III) was accomplished by using a silica gel plate (Eastman, No. 6061) and a mixed solution of 10% sodium carbonate and 10% ammonium molybdate (1:1 v/v) as a developing solvent. Ascending time of 90 minutes was sufficient for clear-cut of Cr(VI). The R_f value of Cr(VI) was 0.71, whereas Cr(III) remained at the starting point. Analytical results of the synthetic samples showed that the limit of detection for Cr(III) in Cr(VI) was 0.05% and the relative standard deviation was ±5% at the 0.5% of Cr(III) level. This procedure can insure the radiochemical purity of a commercial radiochromate solution product to be more than 99.95%. (auth)

19281 STUDY OF TIN DIFFUSION INTO SILICON BY BACKSCATTERING ANALYSIS. Akasaka, Y.; Horie, K.; Tsukamoto, K. (Mitsubishi Electric Corp., Amagasaki, Hyogo (Japan). Central Research Lab.); Nakamura, G.; Yukimoto, Y. Jap. J. Appl. Phys.; 13: No. 10, 1533-1540(Oct 1974).

Diffusion of tin into Si from tin-doped oxide is studied by the backscattering and channeling analyses. The depth distribution of tin in Si can be fitted to complementary error functions. The diffusion coefficient can be expressed as $D = 0.054 \exp(-3.5 eV/kT)$. The solubility limit in Si and the segregation constant between Si and SiO_2 are estimated to be $6 \sim 8 \times 10^{19}/cm^3$ and 0.066 at 1100°C ~ 1200°C, respectively. The lattice location of tin in Si is also determined by angular scan, and it is found that more than 90% of tin atoms occupy substitutional sites. Uniformity of the concentration over a silicon wafer is also checked with the microanalysis system by using backscattering and is found to be good. Effect of post-diffusion of phosphorous or boron on the depth profile of tin is also studied. (auth)

Separation Procedures

Refer also to abstracts 19372, 19417, and 19535.

19282 (AEC-tr-7422/8) NUKLEONIKA. Translation of Nukleonika; 18: No. 8, 333-382(1973). 48p. (TT-73-54035/8). Dep. NTIS $4.00.

A cover-to-cover translation of vol. 18, no. 8 (August 1973) of Nukleonika is given. Items in the original language were cited in NSA with the following abstract numbers: 29: 7562, 29: 7644, 29: 11707, 29: 11708, and 29: 15832. (RWR)

19283 (ANL-8153, pp 7-17) SEPARATIONS AND ENVIRONMENTAL CHEMISTRY. Jan 1975.

In Chemistry Division annual report, July 1973-June 1974. (Argonne National Lab., Ill. (USA)).

Progress in research on high-speed radiochemical separations by liquid-liquid chromatography is reported. Results of the separation of Am(III) and Cm(III) and the separation of Bk(III) and Cf(III) are given. Application of liquid-liquid extraction to disposal of reactor waste is considered. In the study on the behavior of plutonium and americium in rock strata, the major research effort was aimed at evaluating techniques of measuring the parameters relevant to the migration of the two elements. (LK)

19284 (BM-RI-7990) RECOVERY AND SEPARATION OF RARE EARTH ELEMENTS, BARIUM, AND STRONTIUM FROM BASTNAESITE WITH SULFURIC ACID. Eisele, J. A.; Bauer, D. J. (Bureau of Mines, Reno, Nev. (USA). Reno Metallurgy Research Center). 1974. 10p. Bureau of Mines, Washington, DC.

A bench-scale investigation was conducted of a concentrated H_2SO_4 reaction for recovering and separating rare-earth elements, barium, and strontium from a bastnaesite ore and by-product. Barium and strontium were dissolved in the concentrated acid and precipitated as a mixed product by water dilution. Separation of strontium from barium was effected by reaction with Na_2CO_3 solution, followed by a dilute acid leach of the $SrCO_3$ formed. After removing the barium and strontium from bastnaesite ore, the rare-earth elements were roasted to water-soluble sulfates. The rare-earth sulfate solution was subsequently processed by solvent extraction to produce rare-earth oxides low in lead and magnesium. (auth)

19285 (IEA-356) STUDY ON THE SOLVENT EXTRACTION OF THE LANTHANIDE ELEMENTS, SCANDIUM, URANIUM, AND THORIUM USING TETRACYCLINE AS THE COMPLEXING AGENT. Nastasi, M. J. C.; Lima, F. W. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Sep 1974. 19p. Dep. NTIS (US Sales Only) $4.00.

Acid and extractant concentration dependence for the extraction of the 15 lanthanide elements with benzyl alcohol-tetracycline are reported. The behavior towards solvent extraction of U, Th, and Sc as well as the study of the possibility of using the system tetracycline-benzyl alcohol for the separation of the lanthanide elements and for the separation of U from those elements are presented. (auth)

19286 STUDIES ON THE SODIUM (CESIUM, STRONTIUM)-POLYANTIMONIC(V) ACID ION EXCHANGE EQUILIBRIA IN DILUTE NITRIC ACID SOLUTIONS. Konecny, C.; Hartl, I. (Nuclear Research Inst., Rez, Czech.). Z. Phys. Chem. (Leipzig); 256: No. 1, 17-25(1975).

The systems Sr^{2+} (Na^+, Cs^+)—nitric acid—hydrous antimony pentoxide were studied in more detail, using the ion exchange species prepared by hydrolysis of hexachloroantimonic acid. (LK)

19287 REMOVAL OF RADIOACTIVE MATERIAL BY SO-CALLED MANGANESE-ZEOLITE. Matsumura, T.; Ishiyama, T. Annu. Rep. Radiat. Center Osaka Prefect.; 15: 35-37(1974).

Decontamination property of the so-called manganese-zeolite which was made from montmorillonite was studied by a column method. ^{54}Mn or ^{59}Fe is removed completely. ^{60}Co or ^{137}Cs is removed effectively. It is attributed to the adsorption on a broken-bond of quartz or feldspar. Nitro nitrosylruthenium and (RuORu) nitrate are hardly removed, however, a little amount of nitrato nitrosylruthenium is removed. Contact time of radioactive material with manganese-zeolite is the important factor for the removal of radioactive material. Each radioactive material was hardly removed at the contact time less than 20 min. (auth)

19288 SEPARATION OF VARIOUS OXIDATION STATES OF NEPTUNIUM AND PLUTONIUM BY REVERSED-PHASE PARTITION CHROMATOGRAPHY. Cvjeticanin, D. N.; Vucetic, M. M. (Institut za Nuklearne Nauk Boris Kidric, Belgrade). J. Chromatogr.; 103: No. 2, 305-310(Jan 1975).

The application of reversed-phase partition chromatography, using tri-n-octyl phosphate as the stationary phase and nitric acid as the mobile phase, in the separation and determination of Pu(III), Pu(IV) and Pu(VI) and Np(IV), Np(V) and Np(VI) is described. The partition coefficients, separation factors, and heights equivalent to a theoretical plate were determined as functions of the nitric acid concentration. The separation of different oxidation states of plutonium in samples containing uranium was also investigated. (NL)

19289 ON THE SELECTIVITY OF THE CATION EXCHANGE ON CRYSTALLINE Ce(IV) PHOSPHATE-SULPHATES. Koenig, K. H. (Univ., Frankfurt am Maine). J. Chromatogr.; 102: 99-104(Dec 1974). (In German).

From 3rd symposium on ion exchange; Balatonfuered, Hungary (28 May 1974).

The cation-exchange selectivity of crystalline cerium(IV) phosphate-sulphates is discussed. Examples of practical application in cation separations are given. Among the elements studied are: Cs, Sr, Sc, Y, Ce, Sm, Eu, Tb, Tm, and Th. (NL)

19290 USE OF AQUEOUS THIOCYANATE SOLUTIONS IN LIQUID-LIQUID EXTRACTION AND REVERSED-PHASE EXTRACTION CHROMATOGRAPHY. I. Brikman, U. A. T.; de Vries, D.; Jochemsen, R.; de Jong, G. J. (Vrije Univ., Amsterdam). J. Chromatogr.; 102: 309-317(Dec 1974).

From 3rd symposium on ion exchange; Balatonfuered, Hungary (28 May 1974).

Ten ions (Se, Fe, Co, Ni, Zn, Ag, Cd, Pb, Th, and U) were chromatographed on thin layers of cellulose impregnated with Aliquat 336, Alamine 336 S, Amberlite LA-1 or Primene JM-T, and on non-impregnated cellulose. Solutions of 0.3 to 7M thiocyanate acidified with 0.01 to 1.0N hydrochloric acid were used as eluents; R_f spectra and a number of separations are reported. Percentage extraction versus NCS^- molarity data and results of maximum-loading and spectroscopic measurements for the systems liquid anion exchanger-Co(II)-NCS^- and liquid anion exchanger-Ni(II)-NCS^- are also reported. The sorption strength/extraction efficiency of the exchangers increases in the order Primene < Amberlite < Alamine < Aliquat. Increasing the acidity of the aqueous phase generally decreases the sorption/extraction of the complex metal-thiocyanato anions to a considerable extent. Sorption proceeds through anion exchange for all ions investigated. The Co(II)-containing species extracted into the organic phase is $(R_3R'NH^+)_2Co(NCS)_4^{2-}$ (R, alkyl; R', alkyl or H). Nickel is present in the organic phase predominantly as $Ni(NCS)_4^{2-}$; however, depending upon the diluent used, $Ni(NCS)_6^{4-}$ may also be present. (NL)

19291 ANION-EXCHANGE BEHAVIOR OF SOME ELEMENTS ON A WEAKLY BASIC ANION EXCHANGER IN HYDROBROMIC

ACID MEDIUM. Wodkiewicz, L.; Dybczynski, R. (Inst. of Nuclear Research, Warsaw). J. Chromatogr.; 102: 277-285 (Dec 1974). (In French).

From 3rd symposium on ion exchange; Balatonfuered, Hungary (28 May 1974).

The adsorbability of several elements was studied in the system: weakly basic anion exchange resin Amberlite IRA-68 (Br^-)–HBr + Br_2. Distribution coefficients of more than 30 elements were determined by batch equilibration in the HBr concentration range 0.01 to 12M. In most instances the distribution coefficients increase with increase in acid concentration. Some elements, such as Cu, Co, Fe, Mn, In, Ga and U, are adsorbed only at acid concentrations greater than 4 M. Pt, Hg, Ag and, to a somewhat smaller extent, Au, Tl and Re, show high distribution coefficients in dilute HBr solution. In general, the adsorbabilities of elements on Amberlite IRA-68 in the bromide system are lower than the adsorbabilities in analogous system with strongly basic Dowex 1 resin. The observed differences in distribution coefficients are high enough for some interesting separations to be obtained. The possibility of column separations of several mixtures, such as Eu–U, Zn–Cd–Hg and Cu–Ag–Au, was demonstrated. The influence of temperature on the separation of the latter mixture was studied, and the most important chromatographic parameters (distribution coefficients, separation factors, resolutions and plate heights) were calculated. (NL)

19292 ELUTION OF URANIUM FROM AN ANION-EXCHANGE RESIN BY EXTRACTION WITH AN ORGANIC EXTRACTANT IN THE PRESENCE OF AN AQUEOUS PHASE. Erdelyi, M. (Femipari Kutatointezet, Budapest); Czegledi, B.; Vigvari, M. J. Chromatogr.; 102: 429-431(Dec 1974).

From 3rd symposium on ion exchange; Balatonfuered, Hungary (28 May 1974).

The elution of uranium from anion-exchange resins by dilute sulfuric acid has many advantages, but as a consequence of unfavorable distribution values it has limited value. However, if the sulfuric acid phase serves only as a medium phase, and elution is carried out by organic extraction, the advantages of both elution and extraction are combined, while the undesirable factors can be eliminated. (NL)

19293 COUNTERCURRENT ELUTION OF URANIUM(VI) AND IRON(III) FROM AN ANION-EXCHANGE RESIN. Vigvari, M. (Mecseki Ercbanyaszati Vallalat, Pecs II, Hungary); Erdelyi, M.; Czegledi, B. J. Chromatogr.; 102: 433-436(Dec 1974).

From 3rd symposium on ion exchange; Balatonfuered, Hungary (28 May 1974).

A countercurrent elution method for the separation of uranium and iron was developed. The separation is based on changing the solution composition along the anion-exchange column and on the difference in the stability constants and the ion-exchange distribution coefficients of the sulfate complexes of uranium and iron. (NL)

19294 RADIO-GAS CHROMATOGRAPHY OF METAL CHELATES. Buchtela, K.; Grass, F.; Mueller, G. (Atominstitut der Oesterreichischen Hochschulen, Vienna). J. Chromatogr.; 103: No. 1, 141-151(Jan 1975). (In German).

Volatile chelates of metal ions can be separated by gas chromatography. Detection limits can be improved by using radiolabeled compounds. Acetylacetone and 1,1,1,2,2,3,3-heptafluoro-7,7-dimethyl-4,6-octanedione were labeled with tritium. Separations of Al, Cr, Sc, Y, Ho, Dy, Tb, and Gd were investigated. A proportional counter was used for the detection of radioactivity after separation. In the application of highly labeled chelates, a detection limit of 10^{-15} g of metal is estimated. (auth)

19295 SORPTION OF ALKALINE-EARTH METALS BY SULFONATED CATION-EXCHANGERS FROM ORTHOPHOSPHORIC ACID SOLUTIONS. Filatova, L. N.; Kurdyumova, T. N. J. Appl. Chem. USSR.; 48: No. 2, 274-276(Feb 1975).

Translated from Zh. Prikl. Khim.; 48: No. 2, 271-273(Feb 1975).

The purpose of the present work was to study the influence of high concentrations of orthophosphoric acid on sorption of microquantities of alkaline-earth metals by sulfonated cation-exchangers, in order to obtain data which can be used for selection of the optimal conditions for extraction of these metals present as impurities in phosphoric acid solutions. Ion exchange in 0.5–3M H_3PO_4 solutions conforms to the equation log D equals B-2 log [H^+]. The calculated total concentration of the exchanging ions ensures that spreading of the sorption front does not occur. (LK)

19296 USE OF DIPHTHALOCYANINE ELECTRODE FOR EXTRACTION OF IODINE FROM SOLUTIONS. Moskalev, P. N.; Kirina, N. I. (Liningrad Inst. of Nuclear Physics). J. Appl. Chem. USSR.; 48: No. 2, 370-372(Feb 1975).

Translated from Zh. Prikl. Khim.; 48: No. 2, 371-374(Feb 1975).

Potentials of the start of deposition (omega/sub d/) and the start of dissolution (omega/sub s/) of iodine on a diphthalocyanine electrode from a 0.1 M KCl + 0.1 M HCl solution were determined: in solutions of iodine concentrations of $3.7 \cdot 10^{-5}$–$6.6 \cdot 10^{-7}$ M, omega/sub d/ equals 0.53 +- 0.016 V, omega/sub s/ equals 0.34 +- 0.024 V; in solutions of iodine concentrations below $6.6 \cdot 10^{-9}$ M, omega/sub d/ equals 0.62 +- 0.027 V, omega/sub s/ equals 0.20 +- 0.027 V. It was shown that iodine can be extracted quantitatively from dilute and ultradilute solutions. (auth)

19297 EXTRACTION OF SMALL AMOUNTS OF URANIUM FROM FLUORIDES BY THERMAL REDUCTION WITH CALCIUM. Kashcheev, I. N.; Mirkin, I. A. J. Appl. Chem. USSR.; 48: No. 2, 267-269(Feb 1975).

Translated from Zh. Prikl. Khim.; 48: No. 2, 263-266(Feb 1975).

Extraction of small amounts of metals, including uranium, from fluorides by metallothermic reduction is a specific process which differs from the usual metallothermic production of uranium. Reduction, using calcium, of small amounts of uranium tetrafluoride present in mixtures with lithium and calcium fluorides was studied. (auth)

19298 Ru(IV) EXTRACTION FROM SULFURIC ACID SOLUTIONS. Sinitsyn, N. M.; Borisov, V. V.; Dedova, A. S. (Moscow Inst. for Fine Chemical Tech.). Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.; 18: No. 5, 721-724(1975). (In Russian).

Extraction of Ru(IV) as aquo-hydroxy complexes from sulfuric acid solutions (0.1 to 5.8 M H_2SO_4) by various nitrogen-, phosphorus-, and sulfur-containing extractants was studied. In all cases (except primary amines) the distribution coefficient was no greater than 0.05. Addition of chloride ion to the sulfate solution resulted in formation of a chloro complex of Ru(IV) in the aqueous phase and increased its extraction by primary amines and quaternary ammonium salts. (tr-auth)

19299 Ru(IV) SORPTION BY ANION EXCHANGE RESINS FROM HYDROCHLORIC ACID SOLUTIONS. Sinitsyn, N. M.; Borisov, V. V.; Rovinskii, F. Ya.; Ispravnikova, V. V.; Pakhomova, N. S. (Moscow Inst. for Fine Chemical Tech.). Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.; 18: No. 5, 771-775(1975). (In Russian).

Sorption of Ru(IV) as aquo-hydroxychloro complexes from a hydrochloric acid medium by various anion exchange resins and the chemical state of the ruthenium in the solution were studied. Hydrolysis of the ruthenium complexes led to a sharp decrease in the extraction at hydrochloric acid concentrations less than 1 M. (tr-auth)

19300 PREPARATION OF HIGH-PURITY STRONTIUM BY A COMBINED METHOD. Vakhobov, A. V.; Khudaiberdiev, V. G.; Dusmatova, M. Z.; Kogan, T. A. (Inst. of Chemistry, Dushanbe, USSR). Dokl. Akad. Nauk Tadzh. SSR; 17: No. 10, 38-41(1974). (In Russian).

A process was developed for preparing high-purity strontium by vacuum distillation followed by crystallization from the molten state in an inert-gas atmosphere, i.e., helium or argon. The efficiency of the purification by crystallization decreased gradually with increasing number of cycles, three recrystallizations being selected for process use. The contents of 18 impurities are tabulated; they varied from 10^{-3} to 10^{-7} wt %. The crystallization was effective even when the distillation produced very little purification. The distribution of the concentration of several impurities along the strontium bar after the purification is shown graphically. (TTT)

19301 ELUTION OF Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, AND Y FROM ANION EXCHANGE RESIN COLUMN WITH USE OF ETHANOL–FORMIC ACID–NITRIC ACID MIXTURE. Kakihana, H. (Tokyo Inst. of Tech. (Japan). Research Lab. of Nuclear Reactor); Kurokawa, K. Jap. Anal.; 23: No. 11, 1315-1320(Nov 1974). (In Japanese).

An ethanol–formic acid–nitric acid mixture containing 0.0050 m mol of several rare earth pairs from Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, or Y was passed through a column packed with strong-base anion exchange resin, Amberlyst-A29 in the nitrate form (1.2 cm × 21 cm bed), and the rare earth band formed on the column was eluted with the various mixtures of ethanol, formic acid, and nitric acid. In general the heavier rare earth passed through the column at the faster rate than the lighter one, and Y is eluted between Er and Tm. The most effective compositions of the mixtures for separations of adjoining rare earth groups are: for Yb and Lu, C_2H_5OH-26 M HCOOH-13 M HNO_3 (volume

ratio, 93:3:4); for Tm and Yb, C_2H_5OH-26 M HCOOH-13 M HNO_3 (90:5:5); for Er, Y, and Tm, C_2H_5OH-20 M HCOOH-13 M HNO_3 (90:5:5); for Ho and Er, C_2H_5OH-15 M HCOOH-7 M HNO_3 (90:5:5); for Tb, Dy, and Ho, C_2H_5OH-23 M HCOOH-13 M HNO_3 (85:7:8); and for Gd and Tb, C_2H_5OH-20 M HCOOH-13 M HNO_3 (80:10:10). (auth)

19302 THE ION-EXCHANGE BEHAVIOR OF SOME CATIONS ON CRYSTALLINE ZIRCONIUM PHOSPHATE. Hasegawa, Y.; Tomita, I. (Tokyo Univ. of Education (Japan). Faculty of Science). Bull. Chem. Soc. Jap.; 47: No. 10, 2389-2392(Oct 1974).

The distribution coefficients of Ag^+, Tl^+, K^+, NH_4^+, Mg^{2+}, Ca^{2+}, Sr^{2+}, Ba^{2+}, Co^{2+}, Zn^{2+}, Y^{3+}, and Ce^{3+} have been determined on a crystalline zirconium phosphate ion-exchanger in chloride solution media, and the affinity sequences are presented. pH titration curves and x-ray powder diffraction data were obtained for calcium and barium ions. The ion-exchange capacity of the exchanger for barium ions was found to be 4.4 meq/g, but the x-ray powder patterns were rather unusual as compared to those of other ions studied previously. (auth)

Inorganic, Organic, and Physical Chemistry

19303 (ANL-8153, pp 96-107) STABLE-ISOTOPE STUDIES. Jan 1975.

In Chemistry Division annual report, July 1973-June 1974. (Argonne National Lab., Ill. (USA)).

Structures of bacteriochlorophyll b and the Krasnovskii photoreduction products of chlorophyll a are given. All 55 ^{13}C and 4 ^{15}N NMR transitions in chlorophyl a and its magnesium-free derivative pheophytin a were assigned. ESR of triplet states of chlorophylls a, b, c/sub z/, and c_2 and bacteriochlorophyll a are reported. Experiments in the cultivation of ^{13}C-enriched morning glory plants indicated that the isotope enrichment can produce observable morphological changes. (LK)

Chemical and Physicochemical Properties

Refer also to abstracts 19382, 19813, 20215, 20216, 20218, and 20253.

19304 (ANL-8153, pp 133-144) STRUCTURAL CHEMISTRY. Jan 1975.

In Chemistry Division annual report, July 1973-June 1974. (Argonne National Lab., Ill. (USA)).

In studies on the chemistry of irradiated fuels the structure-determination of $Cs_2Mo_2O_7$ is now complete. Structural studies of beta-U_3O_8 and U_2F_9 are continuing. Major accomplishments in neutron crystallography include a neutron-structure study of $K_2Pt(CN)_4Br_{0.30} \cdot 3H_2O$ and discovery of the HgO_4^+ ion and a nearly symmetric $H_3O_2^+$ ion coexisting in the same crystal ($H_2PtCl_4 \cdot 6H_2O$). In the first study of its kind a symmetric, single-minimum, bent Mo-H-Mo bond was found in a complex hydrido dicarbonyl molybdenum complex by means of single crystal neutron analysis. (LK)

19305 (ANL-8153, pp 178-182) APPLIED PROGRAMS. Jan 1975.

In Chemistry Division annual report, July 1973--June 1974. (Argonne National Lab., Ill. (USA)).

Products of thermal and chemical degradation of coal were studied. Isotopic fractionation effects for atmospheric CO were determined. Lunar material was searched for quarks and laser chemistry is being investigated. (MCG)

19306 (DESY-SR-74/17) PHOTOEMISSION FROM SOLID RARE GASES: ELECTRON ENERGY DISTRIBUTIONS FROM THE VALENCE BANDS. Schwentner, N.; Himpsel, F. J.; Saile, V.; Skibowski, M.; Steinmann, W.; Koch, E. E. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F.R. Germany)). Dec 1974. 4p. INIS.

2 figs.; 1 tab.; 24 refs.

Photoelectron energy distributions for solid Ne, Ar, Kr and Xe were measured for 8 eV $\leq \hbar\omega/2\pi \leq$ 30 eV by use of synchrotron radiation. From these the total width and structure of the valence bands were obtained. The data demonstrate that almost all available band structure calculations fail to predict quantitatively other features than the spin orbit splitting. Photoelectron energy distributions for Xe in Ar and Xe in Ne support this viewpoint. (auth)

19307 THE KINETICS OF THE REDUCTION OF IODINE BY HYDRAZINE. Hasty, R. A. (University of the Witwatersrand, Johannesburg (South Africa). Dept. of Chemistry). Z. Phys. Chem. (Frankfurt); 94: No. 1-3, 53-61(Jan 1975).

1 fig.; 4 tabs.; 13 refs.

The iodide ion dependence of the rate of reaction of iodine and hydrazine was determined. The reaction proceeds via competing paths in acidic solution. Both I_2 and HOI are kinetically important species. Although HOI is the more reactive species, less than 50 per cent of the reaction occurs by the HOI path at $[I^-]$ greater than 0.02 M. For 25.0°C and a pH of 1.3, the rate expression is derived. (auth)

19308 MECHANISTIC INVESTIGATIONS WITH THE AID OF ISOTOPIC LABELING. I. Ring Contraction of 3,3-Dichloro-1,2,3,4-Tetrahydro-2,4-Quinolinediones. Kollenz, G.; Kappe, T. (Graz Univ. (Austria). Inst. fuer Organische Chemie). Ann. Chem. No. 10, 1634-1654(1974). (In German).

3 figs.; 1 tab.; 18 refs.

It has been shown, by means of ^{14}C-labeling, that treatment of 3,3-dichloro-1,2,3,4-tetrahydro-2,4-quinolinediones with 2N NaOH leads to cleavage of the C-3 as CO_2. A mechanism for this ring contraction yielding the inactive dioxindole derivative is discussed. (GE)

Isotope Effects

Refer also to abstracts 19354 and 19366.

19309 (AED-CONF-75-080-009) INVESTIGATION OF THE SYSTEM K/Eu/NH_3. Fink, U.; Jacobs, H. (Technische Hochschule Aachen (F.R. Germany)). 1975. 5p. (In German). INIS.

From meeting of lecturers in chemistry; Duesseldorf, F.R. Germany (7 Apr 1975).

Recent investigations on the system K/Eu/NH_3 are discussed. The behavior of europium in liquid NH_3 in the presence of strong ammonium bases such as KNH_2 was examined with special regard to the transition of Eu^{2+} to Eu^{3+}. A special point of interest was the relation between the chemical crystal structure of Eu^{2+} and the corresponding compounds of the alkaline earth metals Sr and Ca. In addition, ir spectroscopic analyses were carried out for the four isotypic amides of Ca, Yb, Eu, Sr at room temperature, and a neutron diffraction was performed on the deuterostrontium amide. (GE)

19310 KINETIC ISOTOPE EFFECT IN COMBINED OXIDATION AND DECARBOXYLATION OF SOME CARBOXYLIC ACIDS. Azarko, V. A.; Agabekov, V. E.; Mitskevich, N. I. (Inst. of Physical-Organic Chemistry, Minsk). Dokl. Akad. Nauk BSSR; 19: No. 4, 340-342(Apr 1975). (In Russian).

The kinetic isotope effect in the decarboxylation of trimethylacetic and adipic acids deuterated on the carboxylic group and of $(CH_3)_2CDCOOD$ in a medium in which cumol oxidation had been initiated by tertiary butyl peroxide was determined at 135°C. Trimethylacetic acid was decarboxylated chiefly through the carboxyl radical and adipic and isobutyric acids through the intermediate product. (tr-auth)

19311 THERMOCHEMICAL ISOTOPE EFFECTS. II. CH_3OH-CH_3OD, C_2H_5OH-C_2H_5OD, AND H_2O-D_2O IN SELECTED SOLVENTS. Duer, W. C.; Bertrand, G. L. (Univ. of Missouri, Rolla). J. Am. Chem. Soc.; 97: No. 14, 3894-3897(9 Jul 1975).

Standard heats of solution at 25° have been determined for the isotopic pairs methanol-methanol-d, ethanol-ethanol-d, and water-heavy water in a variety of solvents. In every case, the transfer of the deuterated compound from an inert solvent (in the case of water, from the gaseous state) to a hydrogen-bonding solvent is more exothermic than the transfer of the parent compound. The isotope effect on the enthalpy of transfer shows a rough correlation with the difference between the reduced masses of the solvent-solute pair. The isotope effect on the enthalpy of the O-H bond in methanol has also been determined. (auth)

19312 LATTICE VIBRATION SPECTRA. XI. Assignment of the Rotatory Vibrations of Water Molecules in Crystal Hydrates Lutz, H. D.; Klueppel, H. J.; Pobitschka, W.; Baasner, B. (Gesamthochschule Siegen (F. R. Germany). Lehrstuhl fuer Anorganische Chemie). Z. Naturforsch., B; 29: No. 11/12, 723-726(Dec 1974). (In German). 1 fig.; 2 tabs.; 17 refs.

The assignment of the H_2O libratory vibrations in crystal hydrates to the rocking or wagging vibration alternatively using the isotope shift of the HDO librations is discussed. IR spectroscopic data on $BaCl_2 \times 2\ H_2O$, $BaBr_2 \times 2\ H_2O$, $SrCl_2 \times 2\ H_2O$, $BaCl_2 \times H_2O$, $BaBr_2 \times H_2O$, $SrCl_2 \times H_2O$, $SrBr_2 \times H_2O$ and on the deuterated compounds of these hydrates are included. (auth)

19313 THEORY OF TRACER-DIFFUSION IN THE WURTZITE STRUCTURE WITH APPLICATIONS TO HEXAGONAL ICE. Mehrer, H. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Theoretische und Angewandte Physik; Max-Planck-Institut fuer Metallforschung, Stuttgart (F. R. Germany). Inst. fuer Physik). Z. Phys., B; 20: No. 3, 281-288(Apr 1975).

13 figs.; 32 refs.

A theory for the tracer self-diffusion by a vacancy mechanism in the wurtzite-lattice is developed into which the effects of Bardeen-Herring correlation are included in a rigorous way. The isotope effect parameter is calculated for the limiting case in which the jump process may be treated as the jump of an individual particle and by means of classical statistics. As an interesting example self-diffusion in hexagonal ice is considered which occurs by exchange of entire water molecules with molecular vacancies. (auth)

19314 THE VALENCE FORCE FIELD OF DIMETHYLNITROSAMINE. Rademacher, P.; Luettke, W. (Goettingen Univ. (F. R. Germany). Organisch-Chemisches Inst.). Ber. Bunsenges. Phys. Chem.; 78: No. 12, 1353-1356(Dec 1974). (In German).

1 fig.; 4 tabs.; 14 refs.

The valence force field of dimethylnitrosamine was calculated using the frequencies of the seven isotopic species $(CH_3)_2NNO$, $(CD_3)_2NNO$, $(CH_3)_2NN^{18}O$, $(CH_3)_2N^{15}NO$, $(CH_3)_2{}^{15}NNO$, $CD_3(CH_3)NNO$, and $CH_3(CD_3)NNO$. The normal vibrations and the potential energy distributions among the force constants are computed. The force constants indicate a strong conjugation between the NN- and NO-bonds. Root-mean-square amplitudes of vibration, calculated for all important distances, compare well with the corresponding values from electron diffraction. (GE)

19315 THE ORIENTATION OF THE WATER MOLECULES IN THE HYDRATION SPHERE OF THE TETRAETHYLAMMONIUM ION. Hertz, H. G.; Wen, W. Y. (Karlsruhe Univ. (TH) (F. R. Germany). Inst. fuer Physikalische Chemie und Elektrochemie). Z. Phys. Chem. (Frankfurt); 93: No. 1-6, 313-326(Nov 1974).

2 figs.; 1 tab.; 29 refs.

Experimental results for the proton magnetic relaxation time of $HCD_2CD_2N^+(C_2D_5)_3Br^-$ dissolved in D_2O, $^{17}OD_2$, and HDO are reported. From a comparison of the relaxation effect caused by the ^{17}O nuclei with that due to the water protons, the orientation of the water molecules in the hydration sphere of Et_4N^+ has been determined. The mean angle of the water dipole relative to the methyl-water oxygen vector is $\beta_0 = 116°$. This means that on average the water protons preferentially point into the bulk water. (GE)

19316 SOLUBILITY OF ARGON KCl SOLUTIONS IN HEAVY WATER OF DIFFERENT ISOTOPIC COMPOSITIONS AT 283 TO 318°K. Krestov, G. A.; Abrosimov, V. K.; Strakhov, A. N. (Ivanovo Energy Inst., USSR). Izv. Vyssh. Ucheb. Zaved., 18: No. 4, 661-663(1975). (In Russian).

New data were obtained on the solubility of argon in KCl solutions in heavy water of different isotopic compositions at 283–318°K. An anomolous change in the solubility of argon in solutions of ordinary water containing small amounts of D_2O was observed. The data obtained are discussed with consideration of the concept of negative hydration of a stoichiometric mixture of K^+ and Cl^- ions and the effect on it of the electrolyte concentration, temperature, and isotopic composition of the water. (tr-auth)

19317 ISOTOPE EFFECTS IN THE REACTIONS OF ^{80}Br ACTIVATED BY ISOMERIC TRANSITION WITH VARIOUS DEUTERATED PROPANES. Tachikawa, E.; Numakura, K. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Bull. Chem. Soc. Jap.; 47: No. 11, 2749-2753 (Nov 1974).

Product studies of the reactions of recoil ^{80}Br with propanes in binary mixtures with ethane showed that the difference in the energy-loss efficiency of C_3H_8 and C_3D_8 in collision with ^{80}Br was less than 10%. Then, the yields for the substitution of ^{80}Br for atoms or groups have been compared in various deuterated propanes. A reactivity integral-isotope effect has been observed in the yields of products from $CD_3CD_2CD_3$ and $CD_3CH_2CD_3$, except in the case of isopropyl bromide from the latter compound. However, it has been observed only in the yield of isopropyl bromide from $CH_3CD_2CH_3$. These results indicate that the chemical and physical properties of both replaced and residual atoms or groups play a role in the observed isotope effects. With a "complex" formation mechanism, it is suggested that an isotope effect appears mostly when the kinetic energy of the reacting ^{80}Br is at the lower-energy end of the reaction-energy range. (auth)

19318 FAR INFRARED SPECTRA AND INTERNAL ROTATION OF ETHYL FLUORIDE AND DEUTERATED SPECIES. Sugeta, H.; Adachi, Y.; Miyazawa, T. (Osaka Univ. (Japan). Inst. for Protein Research). Bull. Chem. Soc. Jap.; 47: No. 10, 2537-2544(Oct 1974).

Far infrared spectra were measured of ethyl fluoride CH_3CH_2F and deuterated species CH_3CD_2F, CD_3CH_2F, and CD_3CD_2F in the gaseous state. The potential barriers hindering the internal rotation were calculated with various models. Possibly because of isotope effects on structure relaxations due to torsional motion and to zero-point motion of other vibrational modes, the observed potential barriers are slightly different among isotopic molecules; the threefold barrier is lowered on the deuteration of the methyl group. The absorption intensities of the four isotopic species were also measured. The intensity of the torsional vibration of the methyl group is nearly doubled on deuteration of the methyl group but is reduced on deuteration of the methylene group. The observed intensity ratios among isotopic species were in good agreement with the ratios calculated with the intensity theory of the previous study. (auth)

Isotope Exchange and Isotope Separation

19319 (AECL-5025) DEUTERIUM ISOTOPE SEPARATION FACTOR BETWEEN HYDROGEN AND LIQUID WATER. Rolston, J. H.; den Hartog, J.; Butler, J. P. (Atomic Energy of Canada Ltd., Chalk River, Ontario, Chalk River Nuclear Labs.). Mar 1975. 30p. Dep. NTIS (US Sales Only) $4.50, AECL $1.00.

The overall deuterium separation factor between hydrogen and liquid water, alpha, was measured directly for the first time between 280 and 370°K. Values of the equilibrium constant for isotopic exchange between hydrogen and water vapor, K_1, were evaluated from these measurements and literature values of alpha/sub V/, the liquid-vapor separation factor. The resulting K_1 values are in excellent agreement, within 1 percent, with recent theoretical estimates of K_1 calculated from spectroscopic data. The data are in good agreement with values of alpha calculated from measurements of K_1 and alpha/sub V/ given in the literature. The direct measurements of alpha/sub V/ reported in the literature were surveyed and are summarized over the temperature range 273 to 473°K. (auth)

19320 (ANL-8153, pp 183) UTILIZATION OF SPECIAL FACILITIES. Jan 1975.

In Chemistry Division annual report, July 1973--June 1974. (Argonne National Lab., Ill. (USA)).

Isotope separation applications are briefly reported. (LK)

19321 PROCESS FOR ENRICHING A CHEMICAL ELEMENT IN ONE OF ITS ISOTOPES. Dewez, D. Canadian Patent 966,978. 6 May 1975. 6p.

A process for the enrichment of a chemical element in one of its isotopes and especially U-235 is described. A gaseous compound of the chemical element to be enriched is expanded imparting to it a high speed translation motion, separating the solidified particles of the compound by means of a physical effect and recovering the separated particles. The device used for the process is described. (CA)

19322 ION EXCHANGE, ISOTOPE EXCHANGE, AND ISOTOPE SEPARATION. Kakihana, H. (Tokyo Inst. of Tech.). J. Chromatogr.; 102: 47-55(Dec 1974).

From 3rd symposium on ion exchange; Balatonfuered, Hungary (28 May 1974).

Ion-exchange and isotope-exchange reactions are discussed mainly from the theoretical point of view in order to find a general expression for the isotope separation factor. The theoretical expression for the separation factor of boron isotopes is derived for the system containing aqueous boric acid with an anion-exchange resin. Some experimental results for boron isotopes are given and are discussed. Results obtained from a small column are also presented in order to show a new, simple procedure for boron isotope separation, which needs only boric acid as raw material, a column of weakly basic anion-exchange resin for chromatographic purposes and water as eluting agent. (NL)

19323 PROCESS AND APPARATUS FOR PREPARING HYDROGEN HAVING A NATURAL DEUTERIUM CONCENTRATION. Hartmann, F. (to Sulzer Bros. Ltd.). Canadian Patent 963,634. Mar 1975. 11p.

Excess water that is usually formed in a thermal hydrogen production plant is recycled or processed to use the enriched deuterium content for the enrichment of the fresh water vapor or steam supplied to the plant. The deuterium enrichment of the fresh water vapor supply allows the produced hydrogen to have a natural deuterium content rather than less. (CA)

19324 RATES OF IONIZATION OF ARYLAMINO KETONES POSSESSING THE POTENTIALITY FOR INTRAMOLECULAR IMINE FORMATION AND INTRAMOLECULAR PROTON ABSTRACTION. Gitel, S. N.; Gutsche, C. D. (Washington Univ., St. Louis). J. Am. Chem. Soc.; 97: No. 14, 3900-3905(9 Jul 1975).

The rates of ionization of a series of compounds of the general structure $Ar(CH_2)/sub\ n/NHCH_2CH_2CH_2COCH_3$ where Ar is phenyl or 2-pyridyl and n is 0, 1, or 2 have been measured by deuterium exchange methods. On the basis of the results it is concluded that (a) the formation of the cyclic pyrrolinium compounds enhances

the rate of ionization by ca, 10^7 when pyridine is the proton acceptor, (b) the proximity to the pyrrolinium ring of a second positive charge (i.e., the protonated pyridine ring in the 2-pyridyl compounds) enhances the ionization rate via an inductive effect, a field effect, or both, and (c) intramolecular proton transfer occurs to a small but probably real extent in the ionization of the 2-pyridyl compounds in which n is 1 and 2. (auth)

19325 H_2-D_2 AND PROPENE$-D_2$ EXCHANGE REACTION IN THE SOLUTION OF THE STOICHIOMETRIC ELECTRON DONOR-ACCEPTOR COMPLEXES OF PHTHALOCYANINES WITH SODIUM. Naito, S.; Tamaru, K. (Tokyo Univ. (Japan). Dept. of Chemistry). Z. Phys. Chem. (Frankfurt); 94: No. 1-3, 63-69 (Jan 1975).

4 figs.; 2 tabs.; 3 refs.

H_2-D_2 and propene-D_2 exchange reactions were studied in the solution of the stoichiometrie electron donor-acceptor complexes of phthalocyanines with sodium. It was concluded that the H_2-D_2 exchange reaction proceeds through the same dissociative mechanism as that on the solid films. The microwave spectroscopic analysis of propene-d_1 and -d_2 species demonstrated that the coordination states of propene in the solution are normal- and isopropyl half-hydrogenated states, which are the real reaction intermediates of the exchange reaction. Solvent molecules have little effect on the chemisorbed state of propene, although the exchange rate itself is markedly affected. (auth)

19326 HYDROGEN EXCHANGE REACTION OF AROMATIC HYDROCARBONS ON THE STOICHIOMETRIC ELECTRON DONOR-ACCEPTOR COMPLEXES OF PHTHALOCYANINE WITH SODIUM. Naito, S.; Tamaru, K. (Tokyo Univ. (Japan). Dept. of Chemistry). Z. Phys. Chem. (Frankfurt); 94: No. 1-3, 156-158(Jan 1975).

1 fig.; 1 tab.; 2 refs.

The hydrogen exchange reaction between aromatic hydrocarbons and deuterium occurred on the stoichiometric Electron Donor-Acceptor (EDA) complexes of phthalocyanine with sodium. It was suggested that the aromatic compounds are adsorbed on these complexes dissociatively and the reaction proceeds via a multiple exchange mechanism. (auth)

19327 PROCESS FOR HYDROGEN ISOTOPE EXCHANGE AND CONCENTRATION BETWEEN LIQUID WATER AND HYDROGEN GAS AND CATALYST ASSEMBLY THEREFOR. Stevens, W. H. (to Atomic Energy of Canada Ltd.). US Patent 3,888,974. 10 Jun 1975. Priority date 28 Jan 1970, Canada. 20p.

A bithermal, catalytic, hydrogen isotope exchange process between liquid water and hydrogen gas to effect concentration of the deuterium isotope of hydrogen is described. Liquid water and hydrogen gas are contacted with one another and with at least one catalytically active metal selected from Group VIII of the Periodic Table; the catalyst body has a water repellent, gas and water vapor permeable, organic polymer or resin coating, preferably a fluorinated olefin polymer or silicone resin coating, so that the isotope exchange takes place by two simultaneously occurring, and closely coupled in space, steps and concentration is effected by operating two interconnected sections containing catalyst at different temperatures. (auth)

19328 CATALYTIC PROPERTIES OF AQUEOUS SOLUTIONS OF COBALT (II) PENTACYANIDE. III. Isotope Exchange Reaction of Deuterium with Water in the Presence of Cobalt(II) Pentacyanide. Sakharovskii, Yu. A.; Rozenkevich, M. B.; Zel'venskii, Ya. D. (Moscow Chemical Tech. Inst.). Kinet. Catal.; 15: No. 6, 1269-1273(1974).

Translated from Kinet. Katal.; 15: No. 6, 1436-1441(1974).

The effect of various factors (temperature, pressure, ionic strength, catalyst concentration) on the rate of the isotopic exchange of deuterium with water in the presence of a Co(II) pentacyanide catalyst was studied. The rate determining step in isotope exchange is the decomposition of cobalt hydropentacyanide with the evolution of water. A mechanism is proposed for the isotope exchange reaction. (auth)

Feed Materials Processing

Refer also to abstracts 19702 and 19730.

19329 PREPARATION OF URANIUM COMPOUNDS. Mercier, H.; Jean, R. (to Compagnie de Produits Chimiques et Electrometallurgiques Pechiney-Ugine Kuhlmann). Canadian Patent 970,162. 1 Jul 1975. 18p.

A method is described for the production of uranium compounds in a high state of purity comprising the steps of contacting a uranium-bearing material with aqueous sulfuric acid, adjusting the ratio of water and sulfuric acid in the resulting leach solution to within the range of 0.16 to 0.26 to precipitate impurities from the first leach solution, diluting a second leach solution after removal of the precipitate formed to adjust the ratio of water and sulfuric acid to within the range of 0.35 to 0.50. (CA)

Radiation Chemistry

Refer also to abstracts 19282, 19369, 19386, 19882, 20219, 20407, 20422, 20424, 20425, and 21053.

19330 (AED-CONF-75-061-039) EFFECTS OF GAMMA-RADIATION AT PILOT PLANT LEVEL AS COMPARED TO EFFECTS OF PASTEURIZATION ON THE DEWATERING OF SEWAGE SLUDGES. Groneman, A. F. 1975. 9p. (SM-194/608). INIS.

From international symposium on the use of high-level radiation in waste treatment. Status and prospects; Muenchen, F.R. Germany (17 Mar 1975).

3 figs.; 4 tabs.; 12 refs. With abstract. Available from ZAED.

At a pilot plant near Munich efforts were made to estimate the effects of ionizing radiation on dewatering characteristics of different sludges, used for recycling in agriculture. The ease with which sludge drains on drying beds and in mechanical devices is reflected in the value of the specific resistance to filtration. A dose of 300 krad, delivered at an average dose rate of 62 krad per hour in the irradiation plant, was effective for disinfection and reduced the specific resistance to filtration in sludges from the waste water works at Geiselbullach and Starnberg from 24.2×10^9 sec^2/g and 18.0×10^9 sec^2/g to 9.7×10^9 sec^2/g and 5.6×10^9 sec^2/g, respectively. These improved dewatering properties were associated with a clear increase of the compressibility of the anaerobically digested sludges. Pasteurization at 70°C during 30 minutes drastically deteriorated the dewatering properties. The conditioning effect of gamma irradiation persisted for more than 20 days. Evidence indicated that the specific resistance was considerably increased by effects of the recirculating pumping. Alternative designs for irradiation plants are suggested, which may also assure a sufficiently homogeneous irradiation dose but without the adverse effects of excessive pumping. (auth)

19331 (ANL-8153, pp 70-89) RADIATION CHEMISTRY AND PHOTOCHEMISTRY. Jan 1975.

In Chemistry Division annual report, July 1973-June 1974. (Argonne National Lab., Ill. (USA)).

Progress is reported in two of the areas made accessible by picosecond pulse radiolysis. The chemical history of the hydrated electron in the spur has been determined, and reactions of the hydrated electron with high concentrations of solute have been measured and explained. Other studies reported on are initial work of heavy-ion pulse radiolysis and nonequilibrium spin populations in radicals. In the area of pulse radiolysis of gases progress is reported in studies on reactions of the hydroxyl radical, production of the OH radical in hydrocarbon-oxygen systems, reaction of chlorine atoms and and chlorinated radicals, reaction of CN with H_2, and mechanisms of excited state formation. (LK)

19332 (BNL-20210) PHYSICAL PRINCIPLES OF THERMOLUMINESCENCE AND RECENT DEVELOPMENTS IN ITS MEASUREMENT. Levy, P. W. (Brookhaven National Lab., Upton, N.Y. (USA)). 1974. 18p. (CONF-7409128-1). Dep. NTIS $4.00.

From international seminar on applications of science to dating of works of art; Boston, Massachusetts, USA (23 Sep 1974).

The physical principles which are the basis of thermoluminescence techniques for dating and authenticating archaeological and fine art objects are described in non-technical terms. Included is a discussion of the interaction of alpha particles, beta rays, i.e., energetic electrons, and gamma rays with solids, particularly electron-hole ion pair formation, and the trapping of charges by crystal imperfections. Also described is the charge-release process induced by heating and the accompanying emission of luminescence resulting from charge recombination and retrapping. The basic procedure for dating and/or authenticating an artifact is described in a "how it is done" manner. Lastly, recently developed apparatus is described for simultaneously measuring luminescent light intensity and wavelength and sample temperature. Examples of studies made with this "3-D" apparatus are given and applications to dating and authenticating are described. (auth)

19333 (CONF-750549-1) IONIZING RADIATION INDUCED ATTACHMENT REACTIONS OF NUCLEIC ACIDS AND THEIR COMPONENTS. Myers, L. S. Jr. (California Univ., Los Angeles (USA). Lab. of Nuclear Medicine and Radiation Biology). 1975. Contract AT(04-1)-GEN-12. 42p. Dep. NTIS $5.25.

From international symposium on protein and other adducts to DNA; Williamsburg, Virginia, USA (5 May 1975).

An extensive bibliographic review is given of experimental and theoretical data on radiation-induced attachment reactions of nucleic acids and their components. Mechanisms of these reactions are reviewed. The reactions with water, formate, and alcohols, with amines and other small molecules, and with radiation sensitizers and nucleic acid-nucleic acid reactions are discussed. Studies of the reaction mechanisms show that many of the reactions occur by radical-molecule reactions, but radical-radical reactions also occur. Radiation modifiers become attached to nucleic acids in vitro and in vivo and there are indications that attachment may be necessary for the action of some sensitizers. (JSR)

19334 (COO-3221-33) CATALYTIC MECHANISM OF THE MANGANESE CONTAINING SUPEROXIDE DISMUTASE OF ESCHERICHIA COLI STUDIED BY PULSE RADIOLYSIS TECHNIQUE. Progress Report: Period Covered, 1 September 1974–1 July 1975. Pick, M.; Rabani, J.; Yost, F.; Fridovich, I. (Hebrew Univ., Jerusalem (Israel); Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (F. R. Germany); Duke Univ., Durham, N. C. (USA)). 1975. Contract AT(11-1)-3221. 22p. Dep. NTIS $4.25.

The dismutation of O_2^-, catalyzed by E. coli Mn dismutase has been investigated. O_2^- was generated in formate aqueous solutions by pulse radiolysis. When the initial concentration of O_2^-, $[O_2^-]_0$ is less than 10 times the total concentration of the dismutase, $[E]_0$, a reaction first order in both $[O_2^-]$ and $[E]_0$ is observed, the apparent reaction rate constant of which is $(1.5 \pm 0.15) \times 10^9$ M^{-1} sec^{-1}. When $[O_2^-]_0/[E]_0 > 15$, a biphasic process is observed. Under these conditions only about 15 O_2^- radical ions per each dismutase molecule react with a relatively fast rate. Excess O_2^- is removed by a less efficient reaction, also first order in $[E]_0$ and nearly first order in $[O_2^-]$, which has an apparent rate constant $(1.6 \pm 0.26) \times 10^8 M^{-1} sec^{-1}$. The results are interpreted in terms of four oxidation and reduction reactions. (auth)

19335 (COO-3221-34) ONE ELECTRON TRANSFER EQUILIBRIA AND REDOX POTENTIALS OF RADICALS STUDIED BY PULSE RADIOLYSIS. Progress Report: Period Covered, 1 September 1974–1 July 1975. Meisel, D.; Czapski, G. (Hebrew Univ., Jerusalem (Israel); Mellon Inst. of Science, Pittsburgh (USA). Radiation Research Labs.). 1975. Contract AT(11-1)-3221. 34p. Dep. NTIS $4.75.

The pulse radiolysis technique is utilized for measurements of the equilibrium constants for electron transfer between the durosemiquinone radical anion and oxygen, menadione and indigo disulfonate. These equilibrium constants are in turn used for calculations of one-electron redox potentials for these systems. Each of these equilibrium constants was determined experimentally and independently and found to be self-consistent. Only for the reactions of the semiquinones with oxygen could the electron transfer reaction be followed directly. For the reactions between the various quinone/semiquinone systems substantial indirect evidence is presented that these equilibria are achieved rapidly. In those cases equilibrium constants were determined from studies of the effect of quinone concentrations on the relative yields of the semiquinones. A method for distinguishing between kinetic competition and equilibrium is outlined and its usefulness is emphasized. The DQ/DQ^- (DQ = duroquinone) and IDS/IDS^- (IDS = indigo disulfonate) systems were employed as reference couples. Taking E_7^1, the redox potential for the first one-electron reduction step at pH 7, of DQ/DQ^- as -0.235 V or of IDS/IDS^- as -0.125 V both yield $E_7^1 = -0.325$ V for the O_2/O_2^- system (1 atm O_2) and $E_7^1 = -0.20$ for the menadione system. (auth)

19336 (COO-3416-20) RADIATION CHEMISTRY AND MASS SPECTROMETRY OF VOLATILE SILANES AND GERMANES. Progress Report, June 1, 1974–May 31, 1975. Lampe, F. W. (Pennsylvania State Univ., University Park (USA). Dept. of Chemistry). 1975. Contract E(11-1)-3416. 23p. Dep. NTIS $4.25.

Status of the following studies is reported: ion-molecule reactions in silane and organosilane systems; long-lived intermediate complexes in the reaction of silyl ions with ethylene; the bimolecular reaction of silyl radicals; formation of disilane in the D-atom induced decomposition of monosilane; reaction of silyl radicals with acetone; and radiolysis of monosilane-nitric oxide mixtures. (LK)

19337 (FRNC-TH-538) RADIOCHEMICAL OXIDATION OF 4-ISOPROPYL-PYRIDINE. Thin Layer Chromatography Analysis of Radiolytical Products. Riba, M. L. (Toulouse-3 Univ., 31 (France)). 1974. 104p. (In French). INIS.

The oxidation by molecular oxygen of 4-isopropylpyridine gamma-irradiated in liquid phase was studied. The products of reaction, identified as 4-isopropylpyridine hydroperoxide and 4-dimethyl pyridil carbinol, were quantitatively determined by thin-layer chromatography using in situ photodensitometry. The experimental procedures used enabled the selective production of an appreciable amount of hydroperoxide, product that may have important practical applications. This study also points out the accelerating effect of the ^{60}Co gamma radiations on the oxidation reaction. (FR)

19338 (IRE-5/1973) CRITICAL STUDY OF THE INDUSTRIAL APPLICATION OF GAMMA RADIATIONS IN THE AREA OF POLYMER CROSS-LINKING. Dardeene, P.; Schietecatte, W. (Institut National des Radioelements, Brussels (Belgium)). Dec 1973. 46p. Dep. NTIS (US Sales Only) $5.50.

This critical study is in fact a comparative examination of the possibilities of industrial applications by gamma rays and electron beam accelerators offered in the field of the cross-linking of polymers. After a brief study of the effects of ionizing radiation on polymers plus a description of a gamma irradiator and a linear accelerator, the physical characteristics and economic aspects of the two processes are compared. This report does not pretend to catalogue the fields of application of either of these procedures in a definite manner; the choice should depend in each instance on the function of the relative application and if, for certain of these, one or the other of the criterion seems preponderant, for others both laboratory and pilot level tests will be necessary, bearing in mind the further evolution of the technology of these procedures. We therefore wanted to make evident the different parameters influencing the choice. These selection criteria, based on the technological and/or economic aspects are not only valid in the case of the cross-linking of polymers but may also be of general use. (auth)

19339 (N-74-35131) EXPERIMENTS ON THE ORIGIN OF MOLECULAR CHIRALITY BY PARITY NON-CONSERVATION DURING BETA-DECAY. Bonner, W. A. (Stanford Univ., Calif. (USA). Dept. of Chemistry). 1973. 24p. (NASA-CR-140161). NTIS $4.25.

Experiments are described to test a theory for the origin of optical activity wherein the longitudinally polarized electrons resulting from parity violation during radioactive beta decay, and their resulting circularly polarized bremsstrahlung, might interact asymmetrically with organic matter to yield optically active products. Experiments involve subjecting a number of racemic and optically active amino acid samples to irradiation in a 61,700 Ci90SR-90Y beta radiation source for a period of 1.34 years, then examining them for any asymmetric effects by means of optical rotatory dispersion and analytical gas chromatography. In the cases of D,L-leucine, norleucine, norvaline and proline as solids, of D,L-leucine in solution and of D,L-tyrosine in alkaline solution no optical rotation was observed during CRD measurements in the 250–630 nm spectral region. While slight differences were noted in the percent radiolysis of solid D- (12.7 percent) and L-leucine (16.2 percent) as determined by GC, no enrichment of either enantiomer was found. (auth)

19340 (NP-20480(P8), pp 118-119) HEAVY-ION RADIOLYSIS OF LIQUID ALDEHYDES. Matsui, M.; Imamura, M. Dec 1974.

In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

19341 (NP-20480(P8), pp 120-122) OPTICAL AND ESR STUDIES ON SINGLE CRYSTALS OF KBr AND CdS IRRADIATED WITH HEAVY IONS. Kimura, K.; Matsui, M.; Imamura, M. Dec 1974.

In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

19342 (NP-20480(P8), pp 123-125) LET EFFECT ON THE RADIATION-INDUCED POLYMERIZATION OF STYRENE. Yasukawa, T.; Takahashi, T.; Matsui, M.; Imamura, M. Dec 1974.

In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

19343 (ORO-3106-54) RADIATION CHEMISTRY OF HYDROCARBON AND ALKYL HALIDE SYSTEMS. Progress Report, 1 July, 1974–31 July, 1975. Hanrahan, R. J. (Florida Univ., Gainesville (USA). Dept. of Chemistry). 1975. Contract AT(40-1)-3106. 26p. Dep. NTIS $4.50.

In the study of gas phase radiolysis of $C_2F_6-C_2H_6$ mixtures, the effect of 10% added oxygen on major products of the radiolysis in the pure fluorocarbon, pure hydrocarbon, and five intermediate compositions was measured. Work on gas phase radiolysis and photolysis of ethyl bromide was completed. Identification of major and minor products from the gamma radiolysis of C_2F_5I and quantitative measurement of radiolytic yields is nearly complete. Quantitative experiments on the radiolysis of CF_3I have not yet been accomplished, but identification of major and minor radiolysis products is complete. Results from the gamma radiolysis of tetrafluorocyclobutane are presented. (LK)

19344 PHOTOCONDUCTIVITY EXCITATION SPECTRA OF ZnS IRRADIATED WITH FAST ELECTRONS AND NEUTRONS. Yoshida, T.; Fujino, T.; Shono, Y.; Oka, T. Annu. Rep. Radiat. Center Osaka Prefect.; 15: 51-54(1974).

Photoconductivity excitation spectra of ZnS irradiated with 8-MeV electrons of 1×10^{17} cm^{-2} and fast neutrons of 3×10^{17} nvt have been measured by a method with a chopper–lock-in amplifier system. Irradiation with electrons produces excitation bands of photoconductivity around 0.38, 0.56, 0.95, and 1.2 μm, and a quenching band around 0.85 μm. Irradiation with neutrons produces excitation bands around 0.38, 0.43, and 0.56 μm and in the wavelength range from 0.75 to 3 μm. The 0.38-μm band may consist of similar bands to the radiation-produced optical absorption bands near the intrinsic absorption edge and around 0.39 μm. The 0.56-μm band corresponds to the radiation-produced optical absorption band around 0.54 μm. (auth)

19345 CHANGES IN INDUCED CONDUCTIVITY OF HEAVY IRRADIATED POLYETHYLENE WITH ^{60}Co GAMMA-RAYS. Okamoto, S.; Furuta, J.; Hiraoka, E. Annu. Rep. Radiat. Center Osaka Prefect.; 15: 66-70(1974).

The changes in induced conductivity of pre-irradiated polyethylene samples (low and high density polyethylene) are measured as a function of pre-irradiation doses. Their induced conductivities decrease with pre-irradiation doses. The induced conductivity of high-density polyethylene is smaller than of low density polyethylene for pre-irradiated materials. Their causes will be related to the decrease of molecular motion in amorphous region which resulted from heavy cobalt gamma pre-irradiation. (auth)

19346 γ RAY-IRRADIATION EFFECTS IN QUARTZ. Fujino, T.; Yoshida, T.; Okamoto, S. Annu. Rep. Radiat. Center Osaka Prefect.; 15: 58-60(1974).

Irradiation effects of ^{60}Co γ rays up to 8×10^9 R on crystalline quartz were studied by observing electrically its properties of mechanical oscillation. AT cut-oscillator elements of synthetic crystalline quartz having initially an average Q^{-1} of 2.5×10^{-6} in 30.72 MHz, 3rd overtone mode, were used. The fractional change of the frequency is of the order of 10^{-3} after irradiation of 10^9 R and two plateaus exist at the doses of the orders of 10^7 and 10^9 R. Isochronal annealing experiments for the oscillation frequency, internal friction Q^{-1}, and loss factor were made in the temperature range from 300 to 560°K. Assuming that change in the frequency is proportional to the density of radiation-produced defects, the activation energy may be estimated about 0.25 or 0.4 eV according as the reaction of recovery is monomolecular or bimolecular. (auth)

19347 EXAMINATION OF ION-EXCHANGE RESINS BY DERIVATOGRAPHY. Nagy, O.; Gaal, H.; Szabo, J. (Inst. for Electrical Power Research (VEIKI), Budapest). J. Chromatogr.; 102: 77-82(Dec 1974).

From 3rd symposium on ion exchange; Balatonfuered, Hungary (28 May 1974).

The possibility of observing the thermal and radiation stability of polymeric ion-exchange resins by means of a derivatographic method is considered. The thermal processes that take place during thermal decomposition are discussed and their nature is elucidated. Information has been obtained on the process of thermal decomposition of the most frequently used Hungarian ion-exchange resins, and relationships are established between the thermal characteristics, the ionic form of the resin and its divinylbenzene content. Results indicate that the thermal decomposition of ion exchangers based on styrene–divinylbenzene is influenced primarily by their ionic form and secondly by their divinyl benzene content. The radiation used has no effect on the process. (JGB)

19348 STUDY OF PEROXIDASE MECHANISMS BY PULSE RADIOLYSIS. The Rate of Reaction of O_2^- and HO_2 Radicals With Horseradish Peroxidase Compound I. Bielski, B. H. J. (Brookhaven National Lab., Upton, NY); Gebicki, J. M. Biochim. Biophys. Acta; 364: No. 2, 233-235(Oct 1974).

Horseradish peroxidase (donor: H_2O_2 oxidoreductase, EC 1.11.1.7) Compound I forms when the enzyme reacts with hydrogen peroxide. Rates of reaction of O_2^- and HO_2 radicals with Compound I were measured in the pH range 3.8 to 8.8. The rate constants were $1.6 \cdot 10^6$ M^{-1} s^{-1} for O_2^- and $2.2 \cdot 10^6$ M^{-1} s^{-1} for HO_2. (INIS)

19349 OXIDATION OF PHENOL TO PHENOXYL RADICAL BY O^-. (Carnegie-Mellon Univ., Pittsburgh). J. Am Chem. Soc.; 97: 912(1975).

Previous investigations have indicated that the predominant product of the reaction of O^- with the phenoxide anion is the phenoxyl radical. Pulse radiolysis studies provided evidence that the reaction occurs directly via transfer of an electron from the phenoxide anion to O^-, i.e., $^{\cdot}O^- + C_6H_5O^- \rightarrow OH + C_6H_5\dot{O}$ in the presence of water. (JGB)

19350 VINYL ESTER RESIN AND PROCESS FOR CURING SAME WITH IONIZING RADIATION IN THE PRESENCE OF AMINES. Mani, I. (to The Dow Chemical Co.). US Patent 3,882,003. 6 May 1975. Filed date 27 Aug 1973. 8p.

The addition of about 2 to 5 weight percent of certain amines to a thermosettable mixture of certain vinyl monomers and a polymerizable vinyl ester resin reduces the dosage level of ionizing radiation required to cure the mixture. (auth)

19351 VINYL ESTER RESIN AND PROCESS FOR CURING SAME WITH IONIZING RADIATION IN THE PRESENCE OF AMINES. Mani, I. (to The Dow Chemical Co.). US Patent 3,882,004. 6 May 1975. Filed date 27 Aug 1973. 6p.

The addition of about 1.5 to 5 weight percent of certain amines to a thermosettable mixture of an alkenyl aromatic monomer and a polymerizable vinyl ester resin reduces the dosage level of ionizing radiation required to cure the mixture. (auth)

19352 METHOD FOR CURING ALKYD RESIN COMPOSITIONS BY APPLYING IONIZING RADIATION. Watanabe, T.; Murata, K.; Maruyama, T. (to Kansai Paint Co.). US Patent 3,882,006. 6 May 1975. Priority date 27 Nov 1969. Japan. 10p.

An alkyd resin composition is prepared by dissolving a polymerizable alkyd resin having from 10 to 50 percent of oil length into a vinyl monomer. The polymerizable alkyd resin is obtained by a half-esterification reaction of an acid anhydride having a polymerizable unsaturated group and an alkyd resin modified with conjugated unsaturated oil having at least one reactive hydroxyl group per one molecule. The alkyd resin composition thus obtained is coated on an article, and ionizing radiation is applied on the article to cure the coated film thereon. (auth)

19353 PROCESS FOR PREVENTING DISCOLORATION IN HYDROLYZED ETHYLENE-VINYL ACETATE COPOLYMERS BY EXPOSURE TO RADIATION. Hoyt, J. M.; Koch, K.; Williams, M. Jr. (to National Distillers and Chemical Corporation). US Patent 3,882,005. 6 May 1975. Filed date 10 Jul 1973. 12p.

A process for the hydrolysis of a solid interpolymer of an ethylenically unsaturated hydrocarbon and a vinyl ester of a 2 to 6 carbon atom aliphatic carboxylic acid to products having a low yellowness index involves contacting of the solid interpolymer with a substantially anhydrous hydrolyzing agent and subjecting at least one of said interpolymer and said hydrolyzing agent to radiation. (auth)

19354 RADIOLYSIS OF POLYATHYLACRYLATE. Rosenberg, A. Munich; Univ. Munich (1972). 73p. (In German). INIS. Thesis.

The radiolysis of polyethylacrylate (PEA) was investigated. To explain the mechanism, the formation of chain cross linkage and chain fractures as well as the formation of volatile products was determined. The influence of a chlorine atom in the β-position of the ethyl ester group on the reaction occurrence was investigated. Partially and fully deuterated PEA was introduced in the ethyl group and the isotope composition of the radiolytically formed hydrogen and of the hydrocarbons were mass spectrometrically examined. The α-position of the ethyl group is strongly favoured in the splitting off of the hydrogen. The hydrocarbons methane, ethane, and ethylene are split off exclusively from the ethyl ester side group. The isotope effect of the hydrogen cleavage also effects the formation of the chain cross linkage. (GE)

19355 ELECTRON SPIN RESONANCE INVESTIGATION ON THE FORMATION OF RADICALS AND RADICAL PAIRS IN γ-IRRADIATED POLYMERS. Hesse, P. Munich; Technische Univ. (1973). 75p. (In German). INIS. Thesis.

The radiation-induced radical formation in various polymers was investigated to explain the mechanism of the radiolysis. The radicals were detected by electron spin resonance spectroscopy (ESR) at −196°C. In polyethyl acrylate, ethyl radicals are mainly split off the side chain, which add on a C = 0 double bond. By increasing the temperature the side chain is broken down further. The following radicals were identified in polypropylene sulfide: $-CH_2-S-CH(\text{radical})(CH_3)-S-C(\text{radical})(CH_3)-CH_2-(\text{radical})S-CH(CH_2)-CH_2-$. From the mechanism discussed that connects the radical formation with the fracture of the main chain, it can be seen that it is mainly splitting of the C–C bond and not of the C–S bond which occurs. Alkyl and allyl radicals were found in 3,4-polyisoprene and in 1,2-polybutadiene. In all of the polymers investigated, radical pairs occurred with high irradiation doses which were shown by Δm = 2 transitions. (auth)

19356 FORMATION OF PATTERNED POLYMER FILM BY IRRADIATION AND ITS APPLICATION. Nonogaki, S. (Hitachi

Ltd., Kokubunji, Tokyo (Japan). Central Research Lab.). Kobunshi; 23: No. 263, 149-152(Feb 1974). (In Japanese).

The photo-etching method to use photo-sensitive resin and exposure to ultraviolet ray is mainly applied to the precise, fine working in photo-engraving and the production process of integrated circuits. Since the requirements for this method have become higher recently, a working method using radiation other than ultraviolet ray has been attempted, which is difficult or impossible to realize by the conventional method. The radiation includes x-rays and electron beam. Resolution improvement is expected when x-rays are used, because they have shorter wavelengths than ultraviolet radiation. The advantages of electron beam are that it can be focused to a very small spot, and etching may be performed by controlling electron beam itself without masking. The chemical reactions to be used for the formation of patterned polymer film are polymerization, bridging reaction, and decomposition. Production and disappearance of polymer, and variation of solubility occur by such reactions due to radiation. Some examples of application are reported. (JA)

19357 ULTRAVIOLET RAY AND ELECTRON BEAM-CURABLE RESINS. Kishi, N.; Kobayashi, J. (Mitsubishi Rayon Co. Ltd., Tokyo (Japan)). Kobunshi; 23: No. 263, 130-134, 152 (Feb 1974). (In Japanese).

The industrial uses of curing coating or ink are increasing as a result of the recent development of high ultraviolet and electron beam generating equipment. These are expected as new systems in view of antipollution, improvement for working environment, high speed processing at room temperature, quality, upgrading and addition of specific properties. Since industrial electron beam accelerators give a dose rate of more than a few Mrad/sec, the radical concentration of a system is 1,000 times as high as that of normal catalytic polymerization. The polymerization system accompanied by cross-linking reaction is selected for curing at such high radical concentration and low dose. In electron beam-curable coating, there are maleic anhydride type unsaturated polyester, acryloyl radical reactive resin, allyl radical reactive resin, sol type resin and others. Main ultraviolet-curable coating resins are unsaturated polyester and its denatured material, which are used by adding photopolymerization-initiating reagent. (JA)

19358 DECOMPOSITION PATHWAYS OF p-BROMOPHENOL ON GAMMA-IRRADIATION IN AQUEOUS SYSTEMS. Komiya, T. (Mie Univ., Tsu (Japan). Faculty of Agriculture); Kawakishi, S.; Namiki, M. Agr. Biol. Chem. (Tokyo); 38: No. 9, 1589-1595 (Sep 1974).

In order to elucidate the radiolysis mechanism of p-bromophenol, quantitative determination of the radiolysis products was carried out by gas chromatography and polarography. G(-p · BP) and G(Br^-) were 3.86 and 2.58 at neutral pH, and 1.09 and 0.26 at pH 1.0, respectively. This, together with the radical scavenger effects indicated that hydrated electrons contribute principally to the degradation of p-bromophenol through debromination, followed by the formation of dimer and trimer products by phenylation of the resulting p-hydroxyphenyl radical. This chain-like reaction may cause the difference (G-value = 1.28) between G(-p · BP) and G(Br^-). The contribution of OH radicals to G(-p · BP) is known to be small as compared with other aromatic compounds, because of the poor yield of hydroxylated products such as hydroquinone, 4-bromocatechol and 4-bromoresorcinol. (auth)

19359 RADIATION-INDUCED IMPREGNATION GRAFTING OF ACRYLIC ACID ONTO POLYESTER FIBERS. Okada, T.; Shimano, Y.; Sakurada, I. (Japan Atomic Energy Research Inst., Neyagawa, Osaka. Osaka Lab. for Radiation Chemistry). Bull. Inst. Chem. Res., Kyoto Univ.; 52: No. 2, 425-435(Sep 1974).

When polyester fiber is impregnated with pure acrylic acid (AA) or AA-water and irradiated with γ-rays from a ^{60}Co source or electron beam from a Van de Graaff accelerator at room temperature almost all impregnated monomer is converted to unextractable PAA, it is to say apparently grafted. However, the degree of apparent graft is several percent, which is too low, since according to our previous experiments about 15% apparent graft is desirable to make polyester fiber as hydrophilic as cotton. When preswelling with a suitable liquid is carried out and the impregnated liquid is replaced with AA or AA-water twice as much AA can be impregnated and converted to unextractable PAA by irradiation. Chlorinated hydrocarbons such as ethylene dichloride and 1,1,2,2,-tetrachloroethylene are found to be more suitable as preswelling agents than conventional swelling agents such as benzyl alcohol, dimethyl formamide, dimethyl sulfoxide or nitrobenzene. When fibers with some additional AA besides really impregnated AA was irradiated in the presence of Mohr's salt after appropriate preswelling, apparent graft higher than 20% can be easily realized at room temperature with high monomer-utilization. (auth)

19360 SOLVENT EFFECTS ON THE RADIATION GRAFT COPOLYMERIZATIONS ONTO POLY(VINYL ALCOHOL). Ikeda, Y.; Horii, F.; Sakurada, I. (Kyoto Univ. (Japan). Faculty of Engineering). Bull. Inst. Chem. Res., Kyoto Univ.; 52: No. 2, 318-331(Sep 1974).

The radiation graft copolymerization of styrene or methyl methacrylate (MMA) onto poly(vinyl alcohol) films was carried out in the presence of swelling agents such as methanol and water. Basing on the variation of conversion, weight increase, and molecular weight of the polymer formed, effects of the swelling agents on the grafting were discussed. In addition the investigation was extended to the grafting systems containing a small amount of chain transfer agents. Methanol has several effects on the heterogeneous grafting other than to accelerate the diffusion of monomers into the substrate matrix. In the grafting of styrene methanol caused an appreciable gel effect, while it behaved as a simple diluent in the grafting of MMA. The chain transfer agents reduced the yield as well as the length of the polymer molecules formed in the film, the chain transfer constant being in agreement with that in the conventional catalytic homopolymerization. The number of grafted branches was not affected by the presence of the chain transfer agent. (auth)

19361 STUDY ON PROCESSING OF EXHAUST GASES BY ELECTRON BEAM IRRADIATION. II. Processing of Exhaust Gases with Flow-Type Apparatus. Kawamura, K.; Aoki, S. (Ebara Mfg. Co. Ltd., Tokyo (Japan)). Ebara Jiho; No. 90, 7-10 (Dec 1974). (In Japanese).

In order to make use of the desulfurization effects found in the batch-type equipment for industrial purpose, a continuous processing unit has been constructed, where combustion exhaust gas was conducted into the reactor and subjected it to electron beam irradiation. Using this testing unit, a series of experiments were carried out and data were obtained concerning the sequence and scaling up of the process. The experiments revealed that the continuous processing unit operates successfully and that exhaust gas can be continuously processed. Also revealed was that with this process, sulfur dioxide can be removed, and mixture of white solid substance and sulfuric acid mist is produced that can be collected by an electrostatic precipitator. (auth)

19362 THE TEMPERATURE DEPENDENCE OF THE G-VALUES OF NITROGEN FROM THE GAS-PHASE GAMMA-RADIOLYSIS OF C_3-HYDROCARBONS IN THE PRESENCE OF NITROUS OXIDE. Okazaki, K.; Yugeta, R.; Kowari, K.; Sato, S. (Tokyo Inst. of Tech. (Japan). Faculty of Science). Bull. Chem. Soc. Jap.; 47: No. 9, 2171-2173(Sep 1974).

The G-values of nitrogen from the gas-phase γ-radiolysis of the propane, propylene, and cyclopropane in the presence of nitrous oxide have been measured at the temperatures from −35 to 150°C. The G-values increased with an increase in the pressure of N_2O and were saturated at about 4 mol % of N_2O. The saturated values, $G(N_2)_{max}$'s showed characteristic temperature dependences. In propane, they scarcely changed with the temperature and stayed at around 2 G_e. Here G_e is the G-value of electrons estimated from the W-value of the hydrocarbon. In propylene, the $G(N_2)_{max}$ changed from G_e at −35°C to about 2 G_e at 150°C, while in cyclopropane it changed from G_e at −35°C to 4.5 G_e at 100°C. Possible reaction mechanisms to explain these results have been discussed. (auth)

19363 THE ESTIMATION OF THE G-VALUES FOR THE IONIZATION AND EXCITATION OF NOBLE GASES IRRADIATED BY 100 keV ELECTRONS. Sato, S.; Okazaki, K. (Tokyo Inst. of Tech. (Japan). Faculty of Science); Ohno, S. Bull. Chem. Soc. Jap.; 47: No. 9, 2174-2180(Sep 1974).

The binary-encounter collision theory has been applied to the calculation of the G-values for the ionization and excitation of noble gases irradiated by 100-keV electrons. The G-values obtained were as follows in the order of He, Ne, Ar, Kr, and Xe: 2.27, 2.19, 2.81, 3.20, 3.45 for G(electrons), 0.85, 1.55, 1.92, 1.64, 1.51 for G(singlet states), and 0.17, 0.07, 0.13, 0.23, 0.39 for G(triplet states). The method of the calculation and the significance of the results were discussed. (auth)

19364 RADIATION CHEMISTRY OF POLYSTYRENE AND STYRENE–BUTADIENE COPOLYMER. Chau, T. C. Waterloo, Ont.; Waterloo Univ. (1973). 159p. National Library of Canada, Ottawa, Order No. 16567.

Thesis (Ph. D.).

Aqueous polystyrene emulsions were gamma irradiated at 30°C and at 0.6 Mrad/hour dose rate. Chain scission was negligible. Attempts to predict a dose-gel relationship were unsuccessful. Cross-linking is postulated to occur through a hot reaction involving adjacent active species. Radiation behavior of gel free butadiene-styrene copolymers at 30°C was independent of dose rate in the range 0.04-0.46 Mrad/hour. Intramolecular crosslinking was evident only with high styrene content copolymer. (CA)

Radiochemistry and Nuclear Chemistry

Refer also to abstracts 21053 and 21055.

19365 (COO-3126-31) NUCLEAR AND RADIOCHEMICAL TECHNIQUES IN CHEMICAL ANALYSIS. Progress Report: Period Covered, 1 June 1974–31 May 1975. Finston, H. L.; Williams, E. T. (Brooklyn Coll., N. Y. (USA). Dept. of Chemistry). 1975. Contract E(11-1)-3126. 39p. Dep. NTIS $5.00.

Progress on the project to determine the neutron-absorption cross section of ^{22}Na is described. Upper limits for the thermal-neutron cross sections of ^{89}Y and ^{139}Ce have been set at 100 barns. The experiment to search for a change in the ratio of electron capture to positron emission due to difference in chemical environment is underway. The mechanical aspects of the system for analysis by proton-induced x-ray emission are described. Recent results on solvent extraction of mercury by pure solvents and propylene carbonate are described. Recent measurements in a study of an acid-base hypothesis are described. (auth)

Hot-Atom Chemistry

Refer also to abstract 19317.

19366 (CRN-CNPA-74-31) SZILARD-CHALMERS EFFECT ON SOME HAFNIUM COMPLEXES. Radiochemical Study and Application to the Perturbed Angular Correlation Method. Marques Netto, A. (Centre National de la Recherche Scientifique, 67-Strasbourg (France). Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67 (France)). 1974. 112p. (In French). INIS.

Solid hafnium of EDTA and CDTA was synthetized. Retentions in /sup 180m/Hf and ^{181}Hf and isotopic effects following (n,gamma) reactions were measured by radiochemical analysis. The influence of irradiation times and thermal annealing were investigated. Time differential measurements of the 133 to 482 keV gamma-gamma angular correlation of ^{181}Ta were performed in solid EDTA and CDTA hafnium complexes either labelled or irradiated in a reactor. The data deduced on the fate of the hot atoms are compared with previous data obtained through radiochemical analysis. As a general conclusion it comes out that radiochemical and PAC experiments appear complementary. Radiochemistry leads to the retention values (around 25 percent) and the PAC results show that the major part of the hot atoms stabilize in a chemical environment quite similar to that in the initial molecule. (FR)

19367 THERMOCHROMATOGRAPHY OF BROMIDES; A PROPOSED TECHNIQUE FOR THE STUDY OF TRANSACTINIDE ELEMENT CHEMISTRY. Zvara, I.; Keller, O. L. Jr.; Silva, R. J.; Tarrant, J. R. (Oak Ridge National Lab., TN). J. Chromatogr.; 103: No. 1, 77-83(Jan 1975).

An interest in elements 105, eka-tantalum, and 104, eka-hafnium, led to the study of the thermal chromatographic behavior of gamma-emitting isotopes of Hf, Nb, and Ta produced by bombarding suitable targets with heavy ions at the Oak Ridge Isochronous Cyclotron. Atoms recoiling from the target were collected, chemically processed, and separated on-line with gaseous bromide systems. A mixture of bromine and boron tribromide was found to be effective as the brominating agent. The separation of the metallic bromides produced was carried out in open tubular columns made of nickel or glass. A possible technique is outlined for the detection of alpha-emitting isotopes, which are of great importance in the transactinide region. Nickel was found to be sufficiently chemically resistant to the brominating atmosphere to be useful as the material for the chamber and target backing. (NL)

19368 REACTION OF TRITIUM RECOIL ATOMS WITH ALKYLBENZENES. Krasnyanskii, A. V.; Nesmeyanov, A. N.; Firsova, L. P.; Yakovlev, N. G. (Moscow State Univ.). Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.; 18: No. 4, 534-537(1975). (In Russian).

Labeled products formed in the action of tritium recoil atoms on liquid toluene and isomers of xylene were studied and their radiochemical yield determined. Based on the ratio of the yield of labeled product and the effect of the addition of iodine, a mechanism of the formation of labeled products is proposed. (tr-auth)

19369 CHEMICAL BEHAVIOR OF RECOIL SPECIES IN BENZENE SOLUTIONS OF NEUTRON-IRRADIATED TRIS(ACETYLACETONATO)COBALT(III) AND TRIS(ACETYLACETONATO) CHROMIUM(III). Nishi, Y.; Tominaga, T. (Tokyo Univ. (Japan). Faculty of Science).. Radioisotopes (Tokyo); 23: No. 12, 700-705 (Dec 1974).

Neutron-irradiated $Co(acac)_3$ or $Cr(acac)_3$ was dissolved in benzene containing various metal acetylacetonate as additives and the change in the apparent ^{60}Co- or ^{51}Cr-retention with the time after the dissolution was investigated at various temperatures. Unstable metal acetylacetonates such as $Mg(acac)_2$ were found to enhance thermal reactions (or the apparent retention) in the solutions. The behavior of the recoil species was very similar in both the irradiated benzene solutions and benzene solutions of the irradiated solids of these complexes. The reactions of the recoil species in solutions of the irradiated $Co(acac)_3$ or $Cr(acac)_3$ and the effects of various additives in such systems (especially the correlation between the apparent scavenging power of metal salts and the stability constant of their acetylacetonates) were explained in terms of recombination, scavenging and ligand transfer reactions. (auth)

Properties of Radioactive Materials

Refer also to abstracts 19287, 20036, 20194, 20195, 20199, 20201, 20298, 20310, and 20423.

19370 (AERE-R-7961, pp 40-44) 5 f DISTRIBUTION OF α AND DELTA PLUTONIUM BY M_{IV-V} SPECTRA. Bonnelle, C. (Univ., Paris). 1975.

From 4th actinides colloquium; Harwell, UK (Jun 1974).

In 4th actinides colloquium.

To obtain information of the 5f distribution of Pu, a study was made of the M_{IV} and M_V spectra; that is to say the $3d_{\frac{5}{2}} \rightarrow 5f$ and $3d_{\frac{3}{2}} \rightarrow 5f$ transitions. Results are reported for plutonium in its α and δ phases using the M_{IV} and M_V absorption spectra. (auth)

19371 (AERE-R-8035) INFRARED AND RAMAN STUDIES ON ACTINIDE(IV) HEXAHALOGENO-COMPLEXES. Brown, D.; Whittaker, B.; Lidster, P. E. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). May 1975. 17p. Dep. NTIS (US Sales Only) $4.00. UK £1.00.

Infrared and Raman spectral data have been recorded for actinide(IV) complexes of the types $M^{I}_{2}M^{IV}Cl_6$ (M^{I} = variously Cs, NEt_4, NBu_4, Ph_4As; M^{IV} = Th-Pu inclusive) and $(NEt_4)_2M^{IV}X_6$ (M^{IV} = Th, Pa and U; X = Br and I). Attempts to observe Raman shifts for analogous hexafluoro-complexes have been successful. The results for the hexachloro-complexes are discussed in relation to previously published, different assignments for the Raman-active mode ν_2, in Th, U and Np complexes. (auth)

19372 (ANL-8153) CHEMISTRY DIVISION ANNUAL REPORT, JULY 1973–JUNE 1974. Peppard, D. F. (Ed.). (Argonne National Lab., Ill. (USA)). Jan 1975. Contract W-31-109-Eng-38. 200p. Dep. NTIS $7.60.

The focal points for a major portion of the Division's research are: nuclear structure and chemical behavior of the heavy elements, interactions of radiation with matter, fundamentals of energy transfer at the atomic and molecular levels, behavior of materials of construction when subjected to extremely high temperatures and/or to bombardment by high-energy particles, the primary photosynthetic process, theoretical modeling of chemical systems, and laboratory automation via computer control. Other important fields of study center on the mutual separation of metals, the inorganic chemistry of elements in unusual states of oxidation, the states of oxidation, the structures and physical properties of nonstoichiometric compounds and of selected compounds possessing special magnetic properties, the composition and origin of extraterrestrial matter, the determination of the age of artifacts, the application of radioactive isotopes in medical diagnoses, and the disposal of radioactive wastes resulting from the reprocessing of spent reactor fuel. Twenty-one sections have been abstracted and indexed for NSA. (LK)

For abstracts of individual sections see: 19235, 19283, 19303–19305, 19320, 19331, 19373–19376, 19395, 19400, 19480, 20448, 20807, 20827, 21032, 21258, 21259, and 21788.

19373 (ANL-8153, pp 1-6) HEAVY-ELEMENT RESEARCH. Jan 1975.

In Chemistry Division annual report, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

The status is reported of studies on the solid-state chemistry of the actinides and lanthanides, spectroscopy of actinide compounds, and dynamic chemical description of actinide elements in solution. Phase studies were done on Rb_2UO_4, K_2UO_4, Li_2UO_4, and $Es_2U_2O_7$. The lithium neptunate (VI) system was investigated and the existence of Li_2NpO_4 was established. In oxidation-reduction studies it was shown that Am(III) can be electrolytically oxidized to Am(IV) in strong H_3PO_4, but Cf(III) and Pr(III) do not oxidize. The low-temperature absorption spectrum of thin films of $NpBr_3$ was investigated. (LK)

19374 (ANL-8153, pp 108-116) HIGH-TEMPERATURE CHEMISTRY. Thorn, R. J.; Ackermann, R. J.; McCreary, J. R.; Rauh, E. G.; Winslow, G. H. Jan 1975.

In Chemistry Division annual report, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

Photoelectron spectra for NdF_3, SmF_3, EuF_3, TmF_3, and YbF_3, and YbF_2 in the 4f region are reported. The point-defect model of uranium has been refined numerically and used exhaustively for predicting properties of hypostoichiometric urania in addition to oxygen partial pressures and total pressures of uranium-bearing species. The structural behavior of the nonstoichiometric U_3O/sub 8-z/ phase was elucidated by gravimetric, thermodynamic and high-temperature x-ray studies. The entropies and enthalpies of sublimation of TmF_3, LuF_3, CsF_3, NdF_3, PrF_3, GdF_3, TbF_3, DyF_3, HoF_3, and ErF_3 were determined. The thermodynamic properties of ZrO(g) and HfO(g) were determined by mass-spectrometric studies of five isomolecular oxygen-exchange reactions. (LK)

19375 (ANL-8153, pp 117-122) LOW-TEMPERATURE CALORIMETRY. Jan 1975.

In Chemistry Division annual report, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

Heat capacity, standard entropy, standard enthalpy, and standard Gibbs energy of $^{243}PuF_4$ from 10 to 350°K, of $^{244}PuO_2$ from 4 to 25°K, of Li_3N from 5 to 350°K, and of Cs_2UO_4 from 5 to 350°K are reported. (LK)

19376 (ANL-8153, pp 145-148) MOLECULAR SPECTROSCOPY. Jan 1975.

In Chemistry Division annual report, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

Spectroscopic studies of lanthanide, actinide, and transition-metal complexes were done to provide a better understanding of the nature of binding in these complexes, and, in the case of the transition-element complexes, of the pressure effects on structural and spin-state conversions. (LK)

19377 (CONF-750915-2) SEARCH FOR PLUTONIUM FLUORESCENCE. Lyster, M. A.; Fellows, R. L.; Young, J. P. (Oak Ridge National Lab., Tenn. (USA)). 1975. 5p. Dep. NTIS $4.00.

From 5th international conference on plutonium and other actinides; Baden-Baden, F. R. Germany (10 Sep 1975).

The possible fluorescence of aqueous Pu in its various oxidation states at room temperature was investigated, over the wavelength range of 300 to 800 nm. For each oxidation state, absorption spectral measurements were made of the experimental solutions, both before and after fluorometric study, to confirm that the desired oxidation state of Pu was studied. No emissions were observed for aqueous solutions of plutonium in any of its oxidation states of (III), (IV), (V), (VI) or (VII). A reaction of thenoyltrifluoroacetone (TTA) with Pu(VI) was found to yield a fluorescent, organic product which might serve as a basis for a fluorometric determination of Pu(VI). In a slightly basic solution, pH 7 to 8, Pu(VI) will oxidize TTA within a matter of seconds to yield a product that exhibits an emission peak at 550 nm with a shoulder at 500 nm. It was demonstrated that Pu(VI) is reduced to Pu(IV) in the reaction with TTA. The method is suited to the fluorometric determination of Pu(VI) even in the presence of Pu(IV), and with the incorporation of photon counting techniques, the determination could be quite sensitive. (auth)

19378 (MLM-2254(OP)) MODEL FOR LIQUID URANIUM AND PLUTONIUM WITH IMPLICATIONS ON THE ADJACENT SOLID PHASES. Wittenberg, L. J. (Mound Lab., Miamisburg, Ohio (USA)). 1975. Contract AT-33-1-GEN-53. 13p. (CONF-750915-9). Dep. NTIS $4.00.

From 5th international conference on plutonium and other actinides; Baden-Baden, F. R. Germany (10 Sep 1975).

The hard-sphere model for liquid metals, which is used to analyze the physical properties of liquid uranium and plutonium, predicted successfully only the compressibility of liquid plutonium while it underestimated the measured viscosity and surface tension values. Based upon a correlation with the rare earth elements, the heat capacities of liquid uranium and plutonium were smaller and their heats of vaporization were larger than predicted. All these deviations suggest additional attractive energy in these two liquids. Diffusion and positron annihilation experiments suggest the appearance of liquid-like clusters in the bcc phases that exist in equilibrium with these liquids. The elastic modulus of /sub epsilon/Pu without these clusters was calculated to be approximately five times larger than the measured modulus. (auth)

19379 (ORNL-5025, pp 79) CHEMISTRY OF NOBELIUM, ELEMENT 102. Dittner, P. F.; Keller, O. L.; McDowell, W. J.; Meyer, R. E.; Silva, R. J.; Tarrant, J. R. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

19380 SYNTHESIS OF HYDRIDO- AND DEUTERIO-CARBONYL CLUSTER COMPLEXES OF RUTHENIUM, IRON–RUTHENIUM, AND OSMIUM FROM METAL CARBONYLS AND HYDROGEN AT ATMOSPHERIC PRESSURE. Knox, S. A. R.; Koepke, J. W.; Andrews, M. A.; Kaesz, H. D. (Univ. of California, Los Angeles). J. Am. Chem. Soc.; 97: No. 14, 3942-3947(9 Jul 1975).

$Ru_4H_4(CO)_{12}$ and $Os_3H_2(CO)_{10}$ are obtained in high yield and purity by reaction of H_2 at atmospheric pressure at 120° in hydrocarbon solutions of $Ru_3(CO)_{12}$, respectively. Further treatment of $Os_3H_2(CO)_{10}$ with H_2 leads to $Os_4H_4(CO)_{12}$. $Ru_4D_4(CO)_{12}$ is obtained from $Ru_3(CO)_{12}$ and D_2 in hydrocarbon solvent; however, extensive hydrogen exchange with solvent is observed in the osmium system. $Ru_4H_2D_2(CO)_{12}$ is obtained in the reaction of D_2 with $Ru_4H_2(CO)_{13}$ and the new mixed metal complex $FeRu_3H_4(CO)_{12}$ is obtained from $FeRu_3H_2(CO)_{13}$ and H_2. Substances are characterized by ir, NMR, Raman, and mass spectrometry. (auth)

19381 UNUSUAL METALLOPORPHYRIN COMPLEXES OF RHENIUM AND TECHNETIUM. Tsutsui, M.; Hrung, C. P.; Ostfeld, D.; Strivastava, T. S.; Cullen, D. L.; Meyer, E. F. Jr. (Texas A and M Univ., College Station). J. Am. Chem. Soc.; 97: No. 14, 3952-3965(9 Jul 1975).

By reaction of dirhenium decacarbonyl, $Re_2(CO)_{10}$, or ditechnetium decarbonyl, $Tc_2(CO)_{10}$, with mesoporphyrin IX dimethyl ester, H_2MPIXDME, or meso-tetraphenylporphine, H_2TPP, monometallic and bimetallic porphyrin complexes of rhenium and technetium were synthesized. Visible spectroscopy indicates that first the monometallic and then the bimetallic porphyrin complex is formed. The monometallic complex of rhenium can further react with either $Re_2(CO)_{10}$ or $Tc_2(CO)_{10}$ to form the homo- and heterodinuclear metalloporphyrin complexes. Structural data for the homodinuclear metalloporphyrin complexes of both rhenium and technetium, TPP[Re(CO)$_3$]$_2$ and TPP[Tc(CO)$_3$]$_2$, were obtained by single-crystal x-ray diffraction. Due to the observed similarity in both their chemical and physical properties, it was assumed that not only the homo- and heterodinuclear metalloporphyrins but also the monometallic porphyrin complexes of Re and Tc have similar structures. Proton magnetic resonance spectrum of (H-TPP)Re(CO)$_3$ gave evidence for the proposed structure of the monometallic porphyrin complexes. In the monometallic complexes, the porphyrin acts as a tridentate instead of a tetradentate ligand, while in the bimetallic complexes the porphyrin acts as a hexadentate ligand; both of these are considered nonclassical coordination numbers for the porphyrin ligand. A fluxional character of both Re and Tc monometallic porphyrin complexes was observed by variable-temperature ^1H NMR spectral studies. This fluxional phenomenon is best explained by the intramolecular rearrangement of the metal-carbonyl group among the four ring nitrogen atoms of porphyrin and a concomitant movement of the N–H proton. A novel thermal disproportionation of (H–MP)Tc(CO)$_3$ to MP[Tc(CO)$_3$]$_2$ and H_2MPIXDME was also observed. A dissociation and recombination of the metal-carbonyl moieties and the porphyrin ligands between two of the (H-MP)Tc(CO)$_3$ molecules would seem interpretable for this unusual coordination phenomenon. (auth)

19382 STRUCTURAL RELATIONSHIPS, CRYSTAL CHEMISTRY AND ANION SUBSTITUTION PROCESSES FOR M(III)X_3 SYSTEMS OF THE LANTHANIDES AND ACTINIDES. Haschke, J. M. (Univ. of Michigan, Ann Arbor). J. Solid State Chem.; 14: No. 3, 238-246(Jul 1975).

An examination of data for lanthanide and actinide phases with UCl_3-type and $PuBr_3$-type M(III)X_3 structures has shown that these systems are conveniently described by alternating layers of $[MX_2]^{n+}_n$ and $[X]^{n-}_n$. The relationships between the UCl_3- and $PuBr_3$-type structures are described and expanded to include a variety of anion substitution systems, M[III]$X_{3-x}Y_x$. The two different types of $[MX_2]^{n+}_n$ layers observed in these systems are consistent with the existence of a novel structural unit, $[M_2X_4]^{2+}$. The effects of radius ratio constraints and layering mechanisms on the phase equilibria and anionic substitution processes, polymorphism and crystal growth in the $MX_{3-x}Y_x$ systems are discussed. (auth)

19383 INVESTIGATION OF $UO_4.2NH_3.2HF$ BY SIMULTANEOUS THERMOGRAVIMETRY: DIFFERENTIAL THERMAL ANALYSIS: MASS SPECTROMETRY TECHNIQUE. Wijden, H. (Mettler Instruments AG, Greifensee, Switzerland); Muller, H. M. Thermochim. Acta.; 11: No. 4, 425-432(Apr 1975).

Thermal decomposition of $UO_4.2NH_3.2HF$ was studied under high vacuum and in different gas atmospheres (N_2, O_2, air). Gaseous decomposition products were analyzed and recorded using a quadrupole mass spectrometer. An explanation of decomposition mechanisms under varied experimental conditions is given. Thermal decomposition strongly supports the results of x-ray analysis leading to the formula $UO_4.2NH_3.2HF$. (NL)

19384 BIBLIOGRAPHIEN ZUR KERNFORSCHUNG UND KERNTECHNIK. Sektion 13. Dekontamination. Nr. 10. (Bibliographies in Nuclear Science and Technology. Section 13. Decontamination.

No. 10). Philipp, H.; Wichmann, E. (comps) (Kernforschungszentrum Karlsruhe (F. R. Germany). Literaturabteilung). Leopoldshafen, F. R. Germany; Zentralstelle fuer Atomkernenergie-Dokumentation (Dec 1974). 44p. (In German). (AED-C-13-10).

The bibliography contains summaries on the problems of decontamination of industrial plants and large areas, of materials and equipment (including clothes and foods), human beings and animals, liquids and gases (including aerosols etc.). It also describes decontamination equipment, decontamination systems and methods as well as questions of cost. (GE)

19385 SYNTHESIS OF A SPECIFICALLY CARBON-14 LABELLED DIPYRROLMETHANE AND STUDIES ON THE HEME-BIOSYNTHESIS. Eckert, H. G. Muenster, Ger.; Univ. Muenster (1973). 97p. (In German). INIS.

Thesis.

The biosynthesis of the cyclic tetrapyrrols is described along with the planning of the synthesis of inactive and (meso-$^{14}CH_2$)-5-amino methyl 4,3'-dicarboxymethyl-3,4'-di-β-carboxy ethyl dipyrryl methane and the carrying out of the synthesis of the ^{14}C-labelled substance, feeding experiments with (meso-$^{14}CH_2$)-amino methyl dipyrryl methane, ($^{14}CH_2$-NH_2) porphobilinogene and ($^{14}CH_2$) glycine; the applied chromatographic method, the synthesis paths to the pyrrol starting compounds, the synthesis of the (meso-$^{14}CH_2$)-amino methyl dipyrryl methane, the feeding of the above-mentioned three ^{14}C-labelled substances, "freeze thawing" and tests on chemical condensation of amino methyl dipyrryl methane and porphobilinogene are dealt with in an experimental section. (GE)

19386 TRITIUM OXIDATION IN AIR UNDER THE ACTION OF ITS OWN RADIATION. Belovodskii, L. F.; Gaevoi, V. K.; Grishmanovskii, V. I.; Nefedov, N. V. At. Energ. (USSR); 38: No. 6, 379-381(Jun 1975). (In Russian).

Experimental results on the determination of the rate of transformation of tritium into oxide under the action of its own radiation in air of 50% relative humidity and in a dry argon medium with up to 20% oxygen added are presented. It was established that, at temperature of 25 ± 3°C, pressure ~700 torr and tritium concentration $6,3 \times 10^{-4}$ to 600 Ci/l, the initial tritium transformation rate depends on its concentration. (2 figures, 1 table, 6 references.) (auth)

19387 BIOSYNTHESIS OF VERRUCARIN AND RORIDIN. V. Synthesis of Two Diastereoisomeric Pairs of [1,8-^{14}C]-α-Bisabolol and Studies on Its Incorporation into Verrucarol. Knoll, W.; Tamm, C. (Univ., Basel). Helv. Chim. Acta; 58: No. 4, 1162-1171(1975).

The diastereoisomeric (+)-[1,8-^{14}C]-(1'R, 6R, S)-α-bisabolol (2a) and (-)-[1,8-^{14}C]-(1'S,6R,S)-α-bisabolol (2b) were synthesized by reaction of the Grignard compound of [1,6-^{14}C]-5-bromo-2-methyl-2-pentene (12) with (+)-(R)- and (-)-(S)-4-acetyl-1-methyl-1-cyclohexene, (6a) and (6b) respectively. For the preparation of compound 12, cyclopropyl methyl ketone was treated with [^{14}C]-methyl magnesium iodide to form the carbinol 11, which was cleaved by HBr. Compounds 6a and 6b were synthesized from (+)-(R)- and (-)-(S)-limonene, (4a) and (4b), via the derivatives 5a, 6a and 5b, 6b respectively. —This synthesis established the absolute configuration at C(1') of the natural α-bisabolols: (R) for (+)-α-bisabolol and (S) for (-)-α- bisabolol. — Feeding experiments with cultures of Myrothecium roridum and radioactive (+)-(1'R, 6R, S)- and (-)-(1'S, 6R, S)-α-bisabolol (2a) and (2b) gave negative results. These findings indicate that bisabolane derivatives are not intermediates in the biosynthesis of verrucarol (3). (auth)

19388 BIOSYNTHESIS OF JUVENILE HORMONE IN THE CECROPIA MOTH. Labelling Pattern from 1-[^{14}C]-Propionate Through Degradation to Single Carbon Atom Derivatives. Peter, M. G.; Dahm, K. H. (Texas A and M Univ., College Station). Helv. Chim. Acta; 58: No. 4, 1037-1048(1975).

From 169th ACS National Meeting; Philadelphia, PA (6 Apr 1975).

In the adult male cecropia moth, 1-[^{14}C]-propionate is incorporated specifically into juvenile hormone I (1). By chemical degradation it was found that only C(7) and C(11) are labelled, each carbon atom bearing 50% of the radioactivity originally present in JH-I. It is concluded that propionate serves as a precursor of homomevalonate, which in turn is a precursor for JH-I. Application of 2-[^{14}C]-propionate and 3-[^{14}C]-propionate leads to extensive randomization of the label. Apparently propionate is metabolized such that C(2) and C(3) can be reused as smaller fragments—probably acetate—while C(1) is either highly diluted or removed from the propionate in a metabolically inactive form. (auth)

19389 A SIMPLE, RAPID, AND EFFICIENT PREPARATION OF ^{99m}Tc-COMPOUNDS BY ELECTROLYSIS. IV. ^{99m}Tc-Tetracycline. Ikeda, I.; Inoue, O.; Uchida, J.; Sugisawa, Y.; Kurata, K. (Dainabot Radioisotope Labs. Ltd., Tokyo (Japan)). Radioisotopes (Tokyo); 23: No. 10, 551-556(Oct 1974). (In Japanese).

The electrolysis method was applied to the labeling of tetracycline and oxytetracycline with ^{99m}Tc. The product may be expected as a tumor localizing agent or a kidney scanning agent. The labeling efficiency depends on the pH of electrolytic solution and the quantity of electricity. Under the optimum condition, the labeling efficiency was found to be 90 to 95% by the use of Sn-Pt electrodes. The labeled products must be used within one hour after the preparation, because they were unstable in aqueous solution and ^{99m}Tc was released as $^{99m}TcO_4^-$ in the course of time. The organ distribution was determined by the use of mice and rats with or without Yoshida sarcoma. Rapid clearance from blood and slow excretion from kidney gave a good image of kidney 1 to 3 hr after the administration in rats. The localization of ^{99m}Tc-tetracycline and ^{99m}Tc-oxytetracycline into tumor was not remarkable. The labeled products presented here may be expected as a kidney scanning agent. (auth)

19390 LABELLING OF COLLOID WITH ^{99m}Tc BY ELECTROLYTIC METHOD AND APPLICATION TO LIVER SCANNING. Bunko, H. (Kanazawa Univ. (Japan). School of Medicine); Tatsuno, I.; Kato, S. Radioisotopes (Tokyo); 23: No. 12, 706-711 (Dec 1974). (In Japanese).

Plans were made to label colloid with ^{99m}Tc by electrolytic method of Ikeda, et al., and performed basic and animal experiments and clinical evaluation of ^{99m}Tc-colloid as liver scanning agent. The ^{99m}Tc-colloid labeled by Ikeda's original method showed marked macroaggregation within one hour after labeling. The original method was modified in the point of pH adjustment using $NaHCO_3$ immediately after labeling (pH = 1.2 → pH = 6-7). The labeling efficiency of the ^{99m}Tc-colloid was over 94 to 99%. Particle size of the colloid observed with microscope was about 4 μ and fairly uniform. The half time of blood disappearance and peak accumulation time in the liver of ^{99m}Tc-colloid in man were 1.1 min and 10 min respectively. The linear scans showed a clear single peak at the level of the liver, and body background of the chest was slightly higher than that of abdomen. Animal experiments showed about 20% of the total dose remained in the lungs, and it seemed difficult to use ^{99m}Tc-colloid clinically. The effective half-life in the liver in experimental animals and in man were 6 hr and 5.5 hr, and in the spleen, 4.8 hr and 3.2 hr, respectively. Splenic visualization was more marked in ^{99m}Tc-colloid than in ^{99m}Tc-Sn-colloid. From these results, ^{99m}Tc-colloid prepared by electrolytic method seemed to be useful in clinical application. (auth)

19391 ELECTROPHORETIC BEHAVIOR OF RUTHENIUM AND ITS SURROUNDING ELEMENTS. Kiso, Y. (Hiroshima Univ. (Japan). Faculty of Engineering). Kagaku No Ryoiki; 28: No. 6, 496-503(Jun 1974). (In Japanese).

Chemical behavior of chloro-aqueous complex of ^{106}Ru which is one of the released polluted nuclides in the reprocessing of fuels, movement degree of chloro complexes, and behavior of its homogenous elements were examined by electrophoresis. The distribution of Ru(III) chloro complex varied according to the early stage concentration of hydrochloric acid and its aquotization reached equilibrium when left alone in 0.1 N HCl for 200 minutes. Similarly, the distribution of Ru(IV) chloro complexes depended on the early stage concentration of hydrochloric acid. With respect to melting condition of ^{106}Ru(III) in sea water, anions and cations existed largely in HCl and HNO_3, respectively. Concerning movement degree, separation zone of anions first increased with time of leaving, but it diminished after leaving for 720 minutes. As for cations, separation zone was produced after 170 minutes and its movement degree increased with time. Radiation intensity of ^{106}Ru diminished within 48 hours except anion separation zone and neutral complexes showed its peak of intensity after 1080 hours which was $1/_{100}$ of the former. Cation C-1 and C-2 of sea water system, which were the most dangerous in Ru complexes, diminished after 50 hours, but C-3 diminished after 1000 hours of leaving. Movement condition of homogenous platinum elements showed the same results as Ru. (JA)

19392 RATE EQUATION FOR THE REACTION OF URANIUM WITH HYDROGEN. Hashino, T. (Kyoto Univ., Uji (Japan). Inst. of Atomic Energy). Tech. Rep. Inst. At. Energy Kyoto Univ.; No. 164, 1-19(Mar 1974).

A theoretical background is presented for the rate equation proposed in the paper published in J. Phys. Chem. 77: 2236 (1973). The equation is derived from the classical theory of rate processes, in view of the fact that Lacher's isotherm is within the domain of statistical thermodynamics. According to the Wicke's mechanism it is assumed that the reaction is rate-determined by the jumping of hydrogen atom from a chemisorption site to the adjacent interstitial site. Unlike usual treatment for

diffusion, the calculation of the potential energy barrier for the hydrogen jumping, because uranium metal suffers a considerable lattice deformation on the reaction as a result of the strong mutual interaction forces among the uranium and hydrogen atoms in the solid phase. As an approximate treatment, the problem is solved with the aid of the continuum theory of lattice defects developed by Eshelby. Thus, the potential energy barrier, including the contribution of the mutual interaction of hydrogen atoms which characterizes Lacher's isotherm, can be obtained in terms of the strain energy, regardless of the nature of the mutual interaction forces. It is shown that the rate equation derived is sufficient to explain the peculiar phenomena which the system exhibits. (auth)

19393 REACTION OF URANIUM OXIDE WITH HEXACHLOROPROPENE. Ito, K.; Kanno, T.; Hashimoto, H. (Tohoku Univ., Sendai (Japan). Research Inst. of Mineral Dressing and Metallurgy). Nippon Genshiryoku Gakkaishi; 16: No. 10, 544-548(Oct 1974). (In Japanese).

Chlorination of triuraniumoctaoxide (U_3O_8) with the organic chloride HCP (hexachloropropene) was studied in order to gain basic information useful for the reprocessing of nuclear spent fuels. Hexachloropropene reacts with U_3O_8 at temperatures above 70°C. When mixtures of HCP/U_3O_8 molar ratio above 9 are heated at 100°C for 4 hr, there is seen formation of two kinds of intermediate chloride – $UCl_5 \cdot TCAC$ (TCAC: trichloroacrylyl chloride, $Cl_2C = CClCOCl$) – and a new adduct compound of UCl_6 with $HCP-UCl_6 \cdot nHCP$. The $UCl_5 \cdot TCAC$ is mainly produced at HCP/U_3O_8 molar ratios from 9 to 18, while at higher molar ratios (HCP/U_3O_8) above 24 the $UCl_6 \cdot nHCP$ is formed. Also, $UCl_5 \cdot TCAC$ is converted to $UCl_6 \cdot nHCP$ with HCP at 100°C. The $UCl_5 \cdot TCAC$ is soluble in hot HCP, but the new adduct compound is insoluble. Above 110°C, these intermediate chlorides decompose thermally into UCl_4. (auth)

19394 PREPARING OF LABELED WITH ^{113m}In FERRIC HYDROXIDE FOR SCINTIGRAPHIC EXAMINATION OF THE LUNG. Uzunov, I.; Popova, M. (Higher Medical Inst. of Plovdiv, Bulgaria). Folia Med. (Plovdiv); 16: No. 3, 167-170(1974).

The authors propose a quick and effective method for obtaining of labelled with ^{113m}In ferric hydroxyde for scintigraphic examination of the lung. The conditions for its obtaining are described and the influence of pH, quantity of gelatine, and ferric chloride is shown. The end product thus obtained binds ^{113m}In in a high percentage and accumulates almost selectively in the lung. The scintigrams, performed by more than 95 patients, show a better scan in a shorter time and at lower radiation as compared with those made with ^{131}I-MAA. (auth)

Radioactive Waste Treatment

Refer also to abstracts 19749 and 20433.

19395 (ANL-8153, pp 127-132) INORGANIC CHEMISTRY. Jan 1975.

In Chemistry Division annual report, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

Two compounds (O_2SbF_6 and IF_6SbF_6) were tested as chemical reagents for trapping the heavier noble gases (isotopes of radon and xenon) released to the atmosphere by nuclear power plants and fuel reprocessing plants. Results on the Raman scattering of anhydrous liquid HF are reported. (LK)

19396 (ARH-2656B) ATLANTIC RICHFIELD HANFORD COMPANY SEMIANNUAL REPORT, 02 PROCESS DEVELOPMENT, NOVEMBER 1, 1972–APRIL 30, 1973. Hopkins, H. H. Jr. (ed.). (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). Jun 1973. Contract AT(45-1)-2130. 60p. Dep. NTIS $6.00.

Dissolution capability, solvent extraction and ion exchange, incineration capability, and instrumentation improvement are covered in the plutonium scrap processing section. The waste management section covers solidification and encapsulation and public protection assurance. (LK)

19397 (KFK-2089) EXPERIENCES IN THE MANAGEMENT OF PLUTONIUM-CONTAINING SOLID-WASTES AT THE NUCLEAR RESEARCH CENTER KARLSRUHE. Baehr, W.; Hild, W.; Scheffler, K. (Kernforschungszentrum Karlsruhe (F.R. Germany). Abt. Behandlung Radioaktiver Abfaelle). Oct 1974. 14p. (AED-CONF-74-703-001). INIS.

From seminar on the management of plutonium-contaminated solid wastes, OECD-CEA; Marcoule, France (14 Oct 1974).

8 figs.; 6 refs. With abstract in English and German.

Solid-plutonium-containing wastes from a fuel production plant, a reprocessing plant, and several research laboratories are treated at the decontamination department of the Karlsruhe Nuclear Research Center for disposal in the Asse salt mine. Conditioning as well as future aspects in α-waste management are the subject of this paper. (auth)

19398 (LA-5993-MS) CHARACTERIZATION OF TRANSURANIC SOLID WASTES FROM A PLUTONIUM PROCESSING FACILITY. Mulkin, R. (Los Alamos Scientific Lab., N. Mex. (USA)). Jun 1975. 24p. Dep. NTIS $4.00.

Transuranic-contaminated wastes generated in the processing areas of the Plutonium Chemistry and Metallurgy Group at the Los Alamos Scientific Laboratory (LASL) were studied in detail to identify their chemical and physical composition. Nondestructive Assay (NDA) equipment was developed to measure transuranic activity at the 10-nCi/g level in low-density residues typically found in room-generated waste. This information will supply the Waste Management Program with a more positive means of identifying concerns in waste storage and the challenge of optimizing the system of waste form, packaging, and environment of the storage area for 20-yr retrievable waste. A positive method of measuring transuranic activity in waste at the 10-nCi/g level will eliminate the need for administrative control in a sensitive area, and will provide the economic advantage of minimizing the volume of waste stored as retrievable waste. (auth)

19399 RECOVERY OF TECHNETIUM FROM NUCLEAR FUEL WASTES. Carlin, W. W. (to PPG Industries, Inc.). US Patent 3,890,244. 17 Jun 1975. Filed date 24 Nov 1972. 14p.

Technetium is removed from aqueous, acidic waste solutions. The acidic waste solution is mixed with a flocculant, e.g., an alkaline earth metal hydroxide or oxide, to precipitate certain fission products. Technetium remains in solution and in the resulting supernatant alkaline aqueous phase. The supernatant alkaline aqueous phase is made acidic and electrolyzed in an electrolytic cell under controlled cathodic potential conditions to deposit technetium on the cathode. Elemental technetium is removed from the cathode. Technetium is separated from other plated fission product metals by extraction from an alkaline solution with an organic extractant, such as pyridine, having affinity for technetium. Technetium is separated from the organic extractant by steam distillation and the resulting aqueous phase treated with ammoniacal reagent to precipitate technetium as ammonium pertechnetate. The precipitate may be acidified to form an aqueous acidic solution of fission product metal values and the solution electrolyzed in an electrolytic cell under controlled cathodic potential conditions and at a potential sufficiently negative to plate out from the solution those fission product metals desired. The metal deposit is stripped from the cathode and stored until its radioactivity has diminished. (auth)

Radioisotope Production

Refer also to abstracts 19280, 20004, 20025, and 20123.

19400 (ANL-8153, pp 66-61) NUCLEAR MEDICAL ISOTOPE RESEARCH. Jan 1975.

In Chemistry Division annual report, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

^{81}Rb is produced in high specific activity and yield by the reaction ^{79}Br (alpha,2n)^{81}Rb. The ^{81}Rb is purified and absorbed on an ion-exchange column in a minigenerator, which allows the elution, at a rapid rate, of the /sup 81m/Kr daughter in a biologically compatible, sterile solution. Applications of /sup 81m/Kr are described. Chemical binding in tumor cells is being studied and the use of /sup 134m/Cs for myocardial scanning is being evaluated. (MCG)

19401 (CONF-750913-1) PREPARATION AND STUDY OF ELEMENTAL CALIFORNIUM-249. Noe, M.; Peterson, J. R. (Tennessee Univ., Knoxville (USA). Dept. of Chemistry; Oak Ridge National Lab., Tenn. (USA)). 1975. 8p. Dep. NTIS $4.00.

From 4th international transplutonium elements symposium; Baden-Baden, F. R. Germany (13 Sep 1975).

Bulk samples of ^{249}Cf metal were prepared on the 10 mu g scale via the Li metal vapor reduction of $^{249}CfF_3$. Above about 725°C elemental Cf exhibits a face-centered cubic (fcc) structure with an average, room-temperature lattice parameter of 5.75(1)A. Between about 600°C and 725°C, the stable form of Cf metal is another fcc structure with an average, room-temperature lattice parameter of 4.94(1)A. Below 600°C metallic Cf exhibits a double hexagonal closest packed (dhcp) structure with average, room-temperature lattice parameters of a_0 equals 3.39(1)A and c_0 equals 11.01(5)A. By comparison of the metallic radii calculated for these three forms with those of the preceding transuranium elements, it is suggested that the two, lower temperature modifications represent Cf with a metallic valence of three, while the highest temperature form represents a metallic valence of two. Although the data reported here are from the most complete

study to date of elemental Cf, the limitations accompanying such microscale research are duly noted. (auth)

19402 (IFA-RC-8-1974) RADIOISOTOPE PRODUCTION IN THE CYCLOTRON. Popa, L. I. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 16p. (In Romanian). INIS.

The cyclotron offers a potentially powerful tool to technology, industry, and biomedical centers. With this accelerator one can produce a variety of short nuclides that are unavailable from other sources. The conditions for production of the isotopes are described. (auth)

19403 (INIS-mf-1777) ISOTOPE PRODUCTION. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Mar 1973. 31p. (In German). INIS.

The brochure describes briefly the isotope production at the Swiss Federal Institute for Reactor Research at Wuerenlingen. It reveals some details of the operations needed, i.e., encapsulation, irradiation, processing, and physical, chemical, and biological examination as well as packing. (auth)

19404 (NP-20480(P8), pp 133-135) PRODUCTION OF RADIOISOTOPES AND PREPARATION OF LABELED COMPOUNDS FOR MEDICAL USE. Nozaki, T.; Ambe, S.; Iwamoto, M. Dec 1974.

In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research. Wako, Saitama (Japan)).

19405 (ORNL-5025, p 230) ^{237}Pu PRODUCTION. Gross, E. E.; Ludemann, C. A.; Marshall, M. B.; Hahn, R. L.; Ottinger, C. L. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

By the use of a highly enriched ^{235}U metal target with a thickness of 10 MeV and 30-MeV alpha particles at a beam current of approximately 20 mu amp, a substantial quantity of ^{237}Pu was produced by the ^{235}U(alpha,2n)^{237}U reaction. Heat transfer and containment problems were solved by hot pressing the U between two layers of Cu and water cooling the sandwich during the 40-hr bombardment. Ion exchange and solvent extraction techniques were used to separate the ^{237}Pu. (JSR)

19406 BASIC STUDIES ON THE PRODUCTION OF URANIUM-232. Excerpt. Kluge, E. Darmstadt, Ger.; Univ. Darmstadt (1972). 4p. (In German). INIS.

Thesis.

A summary is presented of a dissertation describing a) the production of U-232 by neutron radiation of Th-230 and its daughter product Pa-231, (b) the chemical reprocessing of the targets, and (c) the separation of U-232. U-232 is a suitable energy source for long living isotopic batteries. (GE)

19407 PRELIMINARY STUDY ON PRODUCTION OF XENON-133 FROM NEUTRON-IRRADIATED URANIUM METAL AND OXIDES BY OXIDATION. Tachimori, S.; Amano, H. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). J. Nucl. Sci. Technol. (Tokyo); 11: No. 11, 488-494(Nov 1974).

A method was developed for recovering the fission product ^{133}Xe from several kinds of reactor-irradiated U targets, including Al-U alloy, metallic U, and uranium oxides. In order to observe the release of ^{133}Xe from U compounds at high temperatures, irradiated targets were heated at 500 to 1,000°C in vacuum or under gas flow. The liberated ^{133}Xe was trapped on charcoal beds, and the release rate of ^{133}Xe from the compounds was determined by measuring the activity accumulating in the traps. More than 90% of the ^{133}Xe was liberated from the alloy upon melting and from metal and uranium oxide upon oxidation. The isolated Xe was purified by a system embodying cold traps and cryogenic distillation. The final products were sealed in ampoules. They proved to possess radiochemical purity exceeding 99.9%, and less than 1 μl/ampoule (1 ml) of non-radioactive gaseous contaminants. (auth)

19408 PERTURBATION THEORY FOR PROCESSES OF ISOTOPE IRRADIATION. Nemirovskaya, S. A.; Rudik, A. P. Sov. At. Energy (Engl. Transl.); 37: No. 5, 1190-1191(Nov 1974).

Translated from At. Energ. (USSR); 37: No. 5, 428-429(Nov. 1974).

Calculations of the production of new isotopes by irradiation in nuclear reactors have received great attention in recent times and depend on a large number of constants, when the chain of irradiated isotopes is relatively long. Since in some cases all the constants are known only with poor accuracy, the question arises how the results of the calculations depend upon the degree to which the initial constants are known. The problem is solved with the aid of a methematical method according to which the Hamiltonian and conjugated functions are introduced for processes of isotope irradiation. For the sake of simplicity the simplest chain of obtaining ^{238}Pu from ^{237}Np is considered. The method can be easily generalized to chains with any number of isotopes. (auth)

Reactor Fuel Reprocessing

Refer also to abstract 19775.

19409 (BNWL-1907) TECHNICAL AND ECONOMIC FEASIBILITY OF PARTITIONING HANFORD PUREX PROCESS ACID WASTE. Burns, R. E.; Hartley, J. N.; Lester, D. H.; Roberts, F. P.; Swanson, J. L.; Wheelwright, E. J. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). May 1975. Contract AT(45-1)-1830. 57p. Dep. NTIS $7.60.

A study was made of the technical and economic feasibility of applying the concept of partitioning to Hanford Purex process acidic high-level waste. Partitioning, as used here, means separating from the bulk waste a fraction containing long-lived (>100 years, half-life) radionuclides. Relatively low separation factors are required to achieve the actinide element concentrations in the short-lived fraction which were considered in this study. A parametric study involving a series of residual actinide element concentrations in the short-lived waste fraction was made. These concentrations ranged from 1 ηCi to 10^4 ηCi per gram of solidified waste. Flowsheets were developed which are based on existing technology and which are considered to have good probability of achieving the required actinide element separations. Preliminary cost estimates were made for implementing these separations schemes into the Hanford Purex plant and B-plant complex. (JGB)

19410 (CEA-CONF-2835) SAFETY AND RADIATION PROTECTION IN A FUEL REPROCESSING PLANT. Lefort, G.; Pouteaux, M.; Scheidhauer, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91- Gif-sur-Yvette (France). Dept. de Surete Nucleaire). 1974. 13p. (In French).

From French Spanish Colloquium; Marcoule; Fontenay-aux-Roses, France (25 Apr 1974).

An irradiated fuel processing plant comes under those scheduled installations subject to strict regulations under the law. The material construction conditions (shield, ventilation, control of the process, etc.) are designed to ensure the best possible safety. Also, the training of those running the plant is directed in such a way that they are able to dominate all predictable difficulties. But so that safety may be maintained within the framework defined, there must also be teams whose role is more specific, such as the SPR, the maintenance or emergency services, the processing of waste, and the medical department. The drawing up of a safety file demonstrated the safety of the installation and the cooperation of several specialized committees enabled particularly safe operating conditions to be reached. (FR)

19411 (GA-A-13366) THORIUM UTILIZATION PROGRAM. Quarterly Progress Report: For the Period Ending 28 February, 1975. (General Atomic Co., San Diego, Calif. (USA)). 30 May 1975. 208p. Dep. NTIS $7.60.

Results of work performed under the National HTGR Fuel Recycle Program (also known as the Thorium Utilization Program) at General Atomic Company are presented. Results of work on this program were previously included in a quarterly series on the HTGR Base Program. The work reported includes the development of unit processes and equipment for reprocessing of High-Temperature Gas-Cooled Reactor (HTGR) fuel and the design and development of an integrated line to demonstrate the head end of HTGR reprocessing using unirradiated fuel materials. Work is also described on the evaluation of alternate techniques for fuel reprocessing to surmount possible operating problems with the reference flow sheet and the development of the conceptual design of a target recycle facility to identify the requirements of large-scale recycle of HTGR fuels. (auth)

19412 (HEDL-TME-75-31) PLUTONIUM PARTITIONING IN THE PUREX PROCESS WITH HYDRAZINE-STABILIZED HYDROXYLAMINE NITRATE. Richardson, G. L.; Swanson, J. L. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Jun 1975. Contract AT(45-1)-2170. 92p. Dep. NTIS $5.45.

The use of hydrazine-stabilized hydroxylamine nitrate (HAN) to partition plutonium from uranium in the Purex process was successfully demonstrated in a laboratory multistage contactor. Reduction rate constants for the HAN-Pu(IV) reaction were obtained and used in a generally satisfactory computer simulation of the partition behavior. (auth)

19413 (JAERI-M-5840) LITERATURE SURVEY AND EVALUATION OF THE REMOVAL OF SILICON CARBIDE COATING BY REACTION WITH GASES IN HTGR FUELS. Yazi, E.; Maeda, M. (Japan Atomic Energy Research Inst., Tokyo). Sep 1974. 28p. (In Japanese). INIS.

The reactions of silicon carbide with gases were studied in the literature, with a view of utilizing the process for the head-end step in reprocessing the HTGR fuels. The most promising process for the purpose is found to be halogenation, fluorination in particular, when considering corrosion of the reactor structural materials. To evaluate the practicability, however, experimental studies are necessary on such as the reaction kinetics of silicon carbide and the loss of fuel material due to volatilization during the de-coating. Literature on the reactions of silicon carbide with gases, published from 1950 to 1971, are listed under several headings. (auth)

19414 (KFK-2169) APL USED FOR CONTROL OF A REPROCESSING PLANT. Petruschka, B. (Kernforschungszentrum Karlsruhe (F. R. Germany). Abt. Datenverarbeitung und Instrumentierung). May 1975. 72p. (In German). Dep. NTIS (US Sales Only) $6.75.

A package of interactive APL functions for data maintaining and processing is discussed in some detail. The data is recorded during the cycle of irradiated fuels and is used to control the reprocessing plant at the Karlsruhe Nuclear Research Center (WAK). First nuclear fuel processing is explained. A short justification is given of the reasons why the program language APL and the facilities of the file subsystem APL PLUS had been chosen for data handling. This is followed by the description of workspace and file organization; all main functions and files are described. Finally all functions are listed. An example of a user session and the output of daily and monthly reports from terminal and high-speed printer are presented. (auth)

19415 (ORNL-2788) CHEMICAL TECHNOLOGY DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING AUGUST 31, 1959. (Oak Ridge National Lab., Tenn. (USA)). 22 Sep 1959. Contract W-7405-eng-26. 147p. Dep. NTIS $10.50.

Declassified 18 Aug 1975.

The progress report comprises four parts: power reactor fuel reprocessing; raw materials extraction; feed materials processing; and general research. The status of each project is reported. (LK)

19416 (UCRL-51802(Pt.1)) EVALUATION OF METHODS FOR SEISMIC ANALYSIS OF NUCLEAR FUEL REPROCESSING PLANTS, PART 1. Tokarz, F. J.; Murray, R. C.; Arthur, D. F.; Feng, W. W.; Wight, L. H.; Zaslawsky, M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 7 Feb 1975. Contract W-7405-eng-48. 80p. Dep. NTIS $5.45.

Currently, no guidelines exist for choosing methods of structural analysis to evaluate the seismic hazard of nuclear fuel reprocessing plants. This study examines available methods and their applicability to fuel reprocessing plant structures. The results of this study should provide a basis for establishing guidelines recommending methods of seismic analysis for evaluating future fuel reprocessing plants. The approach taken is: (1) to identify critical plant structures and place them in four categories (structures at or near grade; deeply embedded structures; fully buried structures; equipment/vessels/attachments/piping), (2) to select a representative structure in each of the first three categories and perform static and dynamic analysis on each, and (3) to evaluate and recommend method(s) of analysis for structures within each category. The Barnwell Nuclear Fuel Plant is selected as representative of future commercial reprocessing plants. The effect of site characteristics on the structural response is also examined. The response spectra method of analysis combined with the finite element model for each category is recommended. For structures founded near or at grade, the lumped mass model could also be used. If a time history response is required, a time-history analysis is necessary. (auth)

19417 MATHEMATICAL MODELING OF EXTRACTION PROCESSES FOR NUCLEAR FUEL REPROCESSING. III. Oxidation-reduction Stripping Using Ferrous Salts. Rozen, A. M.; Zel'venskii, M. Ya.; Shilin, I. V. At. Energ. (USSR); 38: No. 6, 367-371(Jun 1975). (In Russian).

A mathematical model of the oxidation-reduction stripping process when reprocessing irradiated fuel element solutions in the case of using inextractable reductants, in particular ferrous salts, has been developed. The model describes the process at the extraction stage of a mixer-settler type and includes material balance equations, accounting for the flow structure, extraction equilibrium equations and kinetic equations of chemical reactions in an aqueous phase. A unit of two extractors has been mathematically modelled for successive separate stripping of plutonium and neptunium. The range of working conditions was determined in which the losses of uranium, plutonium and neptunium do not exceed permissible levels (for uranium < 10 mg/l, plutonium < 0,01% and neptunium < 0.10%. The range of permissible conditions was also chosen for the simultaneous stripping of plutonium and neptunium in the same extractor. The effect of temperature on the process efficiency is considered. It is shown also that in a two-phase system the rate of chemical reactions in an aqueous phase is decreased by a factor of $(1 + \alpha n)$ relative to a single-phase system (α is the distribution factor and n the flow ratio), which leads to a corresponding slowing down of chemical processes in the extraction system. (7 figures, 9 references.) (auth)

19418 SEPARATION OF ANTIMONY-125 IN FISSION PRODUCTS. Akatsu, E.; Tomizawa, T.; Aratono, Y. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). J. Nucl. Sci. Technol. (Tokyo); 11: No. 12, 571-574 (Dec 1974).

Most of the known radioactive nuclides of antimony produced by neutron irradiation of uranium have fission yields below 1% and have half-lives below 60 days. An exception is ^{125}Sb with a half-life of 2.7 yr, which raises its relative importance among the fission products with lapse of time after irradiation, and after 1 yr of cooling, its radioactivity is no longer negligible. This circumstance has led to its being separated from such sources as fallout. No studies have so far been reported on using the nitrate system for this separation, though it is utilized in the reprocessing of spent fuel and in the dissolution of uranium samples. The present work describes a method of separating ^{125}Sb from fission products with use made of silica gel–nitric acid system, and an example of its application to the separation of ^{125}Sb from the spent fuel of JPDR-1. The fuel was irradiated from Oct. 1963 to Sep. 1969. The amount of ^{125}Sb measured after separation was $(1.7 \pm 0.19) \times 10^{-1}$ mCi/g U at June 1972. (auth)

19419 TWENTY YEARS OF RESEARCH ON REPROCESSING OF IRRADIATED FUEL AND RADIOACTIVE WASTE DISPOSAL IN THE NUCLEAR RESEARCH INSTITUTE IN REZ. Kyrs, M.; Malek, Z.; Vesely, V. (Ustav Jaderneho Vyzkumu, Rez, Czech.). Jad. Energ.; 21: No. 5, 181-183(Mar 1975). (In Czech).

The research activities are reviewed and important references given. Both aqueous methods and fluoride technology are included. Methods of the separation of biotoxic radionuclides are considered. (auth)

CONTROLLED THERMONUCLEAR RESEARCH

19420 (EUR-CEA-FC-761) BIBLIOGRAPHIC REVIEW OF IONIZATION, RECOMBINATION, AND EXCITATION COEFFICIENTS OF IMPURITIES PRESENT IN A PLASMA. Mattioli, M. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). Feb 1975. 45p. (In French). Dep. NTIS (US Sales Only) $5.25.

Published calculations on ionization, recombination, and excitation rate coefficients are reviewed. The rate coefficient formulas are given for both light (O, C, N) and heavy (Fe, Mo) impurities detected in tokamak machines. (auth)

19421 PLASMA PHYSICS INDEX. Volume 10, No. 4, 1975. Bibliography, Author Index, Subject Index. Leopoldshafen; Zentralstelle fuer Atomkerenergie-Dokumentation (1975). 163p.

19422 PLASMA PHYSICS INDEX, VOLUME 10, NO. 5, 1975. Bibliography, Author Index, Subject Index. Leopoldshafen; Zentralstelle fuer Atomkernergie-Dokumentation (1975). 160p.

19423 PLASMA PHYSICS INDEX. Volume 10, No. 6, 1975. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1975). 144p.

Plasma Confinement and Heating

Refer also to abstracts 19450 and 19485.

19424 (CEA-CONF-3049) THEORY OF GRILL LAUNCHING FOR LOWER HYBRID RESONANCE HEATING. Brambilla, M. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de la Physique du Plasma et de la Fusion Controlee). 1974. 4p. (CONF-7409126-1). Dep. NTIS (US Sales Only) $4.00.

From 7th European conference on controlled fusion and plasma physics; Lausanne, Switzerland (1 Sep 1974).

The theory of slow wave launching in the lower hybrid resonance frequency domain using a phased waveguide array is presented, and an application is made for the parameters of a large Tokamak device. (auth)

19425 (CONF-750905-6) INTERACTION OF NEUTRAL HYDROGEN AND PLASMA INCLUDING WALL REFLECTION. Clarke, J. F.; Sigmar, D. J. (Oak Ridge National Lab., Tenn. (USA)). 1975. 4p. Dep. NTIS $4.00.

From seventh European conference on controlled fusion and plasma physics; Lausanne, Switzerland (1 Sep 1975).

The kinetic equation for the neutral hydrogen in a hot plasma is solved by taking into account gas feed, Franck-Condon neutrals, wall absorption and re-emission of neutrals, electron impact ionization and charge exchange reactions. Steady state neutral profiles are obtained showing the effect of neutral hydrogen on the ion momentum and energy balance. (auth)

19426 (COO-2456-15) INITIAL SHOCK HEATING IN A HIGH BETA BELT PINCH. Taussig, R. (Columbia Univ., New York (USA)). Jun 1975. 4p. (CONF-750606-5). Dep. NTIS $4.00.

From seventh conference on numerical simulation of plasmas; New York, New York, USA (2 Jun 1975).

The first quarter cycle magnetic field compression of an elongated belt pinch is simulated with a one-dimensional, one fluid, two-temperature MHD code. The full anisotropic classical transport coefficients are used in order to predict accurately the ion and electron temperatures during initial shock heating of the plasma. The numerical scheme is a Lagrangian adaptation of the Hain-Roberts code with an additional iterative loop developed by Schneider to insure convergence when real transport properties are used. An external circuit equation which includes a time varying inductance for the plasma, is coupled to the MHD code. The results of these simulations will provide realistic temperature and density profiles as input to equilibrium and stability analyses for the belt pinch. (auth)

19427 (MATT-1138) SYSTEM FOR RAPID INJECTION OF METAL ATOMS INTO PLASMAS. Marmar, E. S.; Cecchi, J. L.; Cohen, S. A. (Princeton Univ., N.J. (USA). Plasma Physics Lab.). Jul 1975. 24p. Dep. NTIS $4.25.

A system for producing 300 mu s bursts of 10^{17} metal atoms with 3 eV average energy is described. It is shown that this system can be successfully used to introduce impurities into CTR oriented tokamaks for transport and confinement studies. (auth)

19428 (N-75-11152) EXPERIMENTAL INVESTIGATION OF ELECTRON CLOUD CONTAINMENT IN A NONUNIFORM MAGNETIC FIELD. Eninger, J. E. (Avco-Everett Research Lab., Everett, Mass. (USA)). May 1974. 43p. (NASA-CR-120521). NTIS $3.75.

Dense clouds of electrons were generated and studied in an axisymmetric, nonuniform magnetic field created by a short solenoid. The operation of the experiment was similar to that of a low-pressure (approximately 0.000001 torr) magnetron discharge. Discharge current characteristics are presented as a function of pressure, magnetic field strength, voltage, and cathode end-plate location. The rotation of the electron cloud is determined from the frequency of diocotron waves. In the space charge saturated regime of operation, the cloud is found to rotate as a solid body with frequency close to V/sub a/phi/sub a/ where V/sub a/ is the anode voltage and phi/sub a/ is the total magnetic flux. This result indicates that, in regions where electrons are present, the magnetic field lines are electrostatic equipotentials (E bar, B bar equals 0). Equilibrium electron density distributions suggested by this condition are integrated with respect to total ionizing power and are found consistent with measured discharge currents. (auth)

19429 (UCID-16851) TWO-COMPONENT EXPERIMENTS IN 2XIIB. Logan, B. G. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 29 Jul 1975. 41p. Dep. NTIS $5.25.

A design is presented for a gas feed to create a two-component (hot + cold) ion distribution in 2XIIB. Parameters for a radially uniform two-component plasma are estimated from a power balance between neutral beam injection and cold plasma end loss. The electron temperature is found to be beta limited rather than beam power limited, with the hot ion lifetime limited mainly by electron drag. (auth)

19430 PROBLEM OF THERMAL WAVES IN PLASMA, THE INFLUENCE OF HOT ELECTRONS BEING TAKEN INTO CONSIDERATION. Gacek, A.; Kaliski, S.; Sarzynski, A. (Inst. of Fundamental Technological Research, Warsaw). Bull. Acad. Pol. Sci., Ser. Sci. Tech.; 22: No. 12, 1095-1104(1974).

A derivation is given of simplified equations of electron heat conduction with participation of hot electrons. These equations are derived for one- and two-temperature plasma. The examples of computation for one-temperature plasma show distinctly, despite the preheating effect, two separate wave fronts, which opens some prospects for averaged description based on the modified method of momentums. (auth)

19431 STAND OFF LAMINAR ELECTROSTATIC SHOCK GENERATED BY ION BEAMS. Kiyama, H. (Electrotechnical Lab., Tanashi, Tokyo (Japan). Tanashi Branch). Denshi Gijutsu Sogo Kenkyusho Iho; 38: No. 3-5, 210-225(Jul 1974). (In Japanese).

The stand off laminar electrostatic shock has been generated by two ion beams, that is, the fast ion beam and the slow ion beam. The two kinds of steady ion beams pass through a fine and thin mesh which has a potential well, where electrons recoil. After the passage, however, the ion beams are decelerated by lack of electrons. Slow ions are trapped and a peak of ion density exists. As fast ions are decelerated by the peak, their density increases. The electrostatic shock stands off behind the mesh. At a high mach number (up to 5), most part of the slow ions are reflected by the potential hill which is generated by ions themselves and works as an electrostatic piston behind the mesh. At a higher mach number only the electrostatic piston is seen. Ions are not heated so hard in the Laminar shock and are reflected by the piston. Some discussions are made on how to heat the ions for getting high temperature plasmas. (auth)

Plasma Diagnostics

19432 (COO-2444-2) DEVELOPMENT OF A BEAM PROBE DIAGNOSTIC SYSTEM FOR THE UNITED AIRCRAFT "LITE" PROGRAM. Final Report, 1 Apr 1974-31 Mar 1975. Stufflebeam, J. H.; Jennings, W. C.; Connor, K. A.; Hickok, R. L. (Rensselaer Polytechnic Inst., Troy, N. Y. (USA)). Jul 1975. Contract AT(11-1)-2444. 62p. Dep. NTIS $6.25.

A heavy ion beam probe diagnostic system for the LITE plasma device has been designed, fabricated, tested and installed. The beam was aligned and slaved to the LITE magnetic field and the predicted defocusing of the beam was confirmed. A sophisticated Beam Trajectory Programmer to control the operation of the beam probe system was developed and placed into operation. The electrostatic energy analyzer detector system was installed and preliminary noise measurements were made. The system is now ready for final testing under full plasma operating conditions. (auth)

19433 (EUR-CEA-FC-759) A THOMSON SCATTERING DEVICE AND DATA ACQUISITION SYSTEM FOR T. F. R. Charet, M.; Dumay, L.; de Michelis, C.; Platz, P. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Groupe de Recherches sur la Fusion Controlee; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). Feb 1975. 32p. INIS.

The optical and spectroscopic layout of a Thomson scattering system is described. It includes a high power Ruby laser, a grating spectrum analyzer, laser-to-plasma and plasma-to-analyzer matching optics. Scattering spectra are deduced from photomultiplier signals. Two procedures are described. The first, rather classical one, is based on CRT recordings. The second one is fully automatic and computer-assisted. Calibration problems are also treated. Finally, examples of scattering spectra, temperature and density profiles obtained from the plasma of the TFR Tokamak are given. (FR)

19434 (IPP-IV-81) INVESTIGATION OF LASER-TARGET INTERACTIONS WITH PICOSECOND MICROPHOTOGRAPHY. Ariga, S.; Sigel, R. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Mar 1975. 9p. (CONF-750315-1). Dep. NTIS (US Sales Only) $4.00.

From spring conference of the German Society of Physics; Duesseldorf, F. R. Germany (4 Mar 1975).

The investigation of the interaction between the laser light and the pellet in laser-fusion experiments, whose typical time scale is ~100 ps, requires high-speed diagnostics. In this work a 5 ps single pulse from a mode-locked dye laser pulse train was utilized for time-resolved microphotography. The spatial resolution obtained was better than 5 μm. This technique was applied to investigate plasmas produced by a 20 J/5 ns Nd-glass laser pulse with solid targets of deuterium and other materials. Expansion of plasmas, blow-off of target materials with velocities up to 10^7 cm/s, and propagation of shock waves in targets could be studied. (auth)

19435 (UCRL-76667) INTERFEROMETRIC RECONSTRUCTION OF ELECTRON NUMBER DENSITIES IN LASER-INDUCED PLASMAS. Sweeney, D. W.; Attwood, D. T.; Coleman, L. W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 4 Aug 1975. 8p. (CONF-750801-3). Dep. NTIS $4.00.

From topical meeting on image processing for 2-D and 3-D reconstruction from projections: theory and practice in medicine and the physical sciences; Stanford, California, USA (4 Aug 1975).

Holographic interferometry is used to reconstruct the electron number densities in a laser-induced plasma. The axisymmetric plasma field is reconstructed using a Fourier–Bessel series expansion technique. (auth)

19436 NEW METHOD FOR PLASMA DIAGNOSTICS BY EXTERNAL rf SIGNALS APPLIED BY CAPACITIVE COUPLING TO RING PROBES. Chiplonkar, V. T.; Sapre, A. V. (Inst. of Science, Bombay). Indian J. Pure Appl. Phys.; 13: No. 4, 271-272(Apr 1975).

The plasma parameters, viz. the electron number density (n_e) and the electron temperature v_e in volts, were estimated from observations: (i) on the equivalent sheath capacitance C_{sf} at the boundary between a ring probe (when floating) and a gas discharge plasma and (ii) on its dc potential (floating) obtained from measurements on the sheath impedance for varying dc bias, with a probing rf voltage signal (10 kHz). The new method of plasma diagnostics presented with suitable modifications, may provide a useful and accurate method capable of general application. (auth)

19437 ORIENTABLE SECONDARY EMISSION DETECTOR FOR PLASMA EXPERIMENTS. Deck, C.; Iguchi, J.; Jacquinot, J.; Kawabe, T. (Nagoya Univ., Japan). IEEE Trans. Plasma Sci.; PS-3: No. 2, 41-45(Jun 1975).

An orientable secondary emission detector is described. Its response to the fast neutral atom flux emitted by a plasma allows to measure the density profile, the phase space distribution function and the average energy of the plasma ions. (auth)

19438 THE CALIBRATION OF THE ELECTROSTATIC ENERGY ANALYZER FOR QUANTITATIVE UTILIZATION. Saad, H. M. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Jap. J. Appl. Phys.; 13: No. 8, 1278-1283(Aug 1974).

A problem associated with the calibration process of electrostatic analyzers for quantitative utilizations is, often, the selection of an ion source, a detector, and a measuring system. A simple ion source suitable for such a process was selected and calibrated. It showed a linear relation between the electron emission current and the output ion current. A Daly-type detector was used and its characteristic curves were plotted. The absolute amplification factors for both the target and the scintillator were obtained at different target potentials. When, instead of DC measurement, the pulse counting method was applied to near region which the output signal from the photomultiplier began to saturate, the linearity between the input signal and output signal was extended up to about 70 MHz. (auth)

Plasma Kinetics (General)

19439 (FRNC-TH-520) MECHANISM OF THE DISCHARGES ESTABLISHED IN DISPLAY PANELS WITH DIELECTRIC WALLS. Mohamed, K. H. (Toulouse-3 Univ., 31 (France)). 1974. 86p. (In French). Dep. NTIS (US Sales Only) $7.50.

Thesis.

The transistory discharge which is built up in cells of plasma display panels is studied. A scheme for the external circuit-cell coupling is set up. With its help, it is possible to elaborate an experimental tool which gives one the electrical data characteristics of the discharge. Then, a numerical simulation for a monodimensional scheme is made. (auth)

19440 INFLUENCE OF THE COLLISIONAL RECOMBINATION ON THE ELECTROSTATIC FLUCTUATION SPECTRUM IN AN HELIUM PLASMA. Baravian, G.; Bretagne, J.; Godart, J.; Sultan, G. (Paris-11 Univ., 91 - Orsay (France). Lab. de Physique des Plasmas). Z. Phys., B; 20: No. 3, 247-253(Apr 1975).

6 figs.; 3 tabs.; 9 refs.

The collisional recombination, in the afterglow of a dense plasma, is regarded as a source process for an overpopulation of the high energy tail of the electron velocity distribution function. The perturbation of the distribution function leads to an important enhancement of the fluctuations of the electrostatic field in a narrow range near the plasma frequency ω_p. (GE)

19441 SHOCK POLARIC DIAGRAMS FOR MAGNETOGASDYNAMIC FLOWS OF PLASMAS WITH UNLIMITED HIGH CONDUCTIVITY. Hahnemann, H. W. VDI (Ver. Dtsch. Ing.) Z.; 117: No. 6, 288(Mar 1975). (In German).

1 ref.

The article gives a commentated survey of the most important results of the paper by M. Natter: MHD shock polaric diagrams for plasmas of unlimited conductivity (VDI-Forschungsheft 565, Duesseldorf: VDI-Verlag 1974). (GE)

19442 A PENNING ION SOURCE WITH AXIAL EXTRACTION FOR THE PRODUCTION OF HIGHLY CHARGED POSITIVE IONS. Baumann, H. Heidelberg; Univ. Heidelberg (1973). 52p. (In German). INIS.

Thesis.

A penning ion source with axial extraction was developed for a non-pulsed operation with high arc voltage. (1 kV to 6 kV) (cold cathode penning discharge). The magnetic field superimposed to the discharge was generated by a solenoid. The dependence of the extracted total ion current on the source parameters was investigated. The ion current rate of multiple charged positive ions was measured at operation of the ion source with rare gases and gaseous compounds of various elements. The dominating ionization process for generation of multiple charged positive ions is single collision ionization by electrons. The ion currents for the charged states are proportional to the cross sections of ionization. For a charge to mass ratio of 0.046 particle currents of 10^{12} to 10^{16} per sec were accomplished. (auth)

19443 PERTURBATIONAL SPECTROSCOPIC STUDIES WITH ARGON PLASMAS. Belzer, H. Heidelberg; Univ. Heidelberg (1973). 158p. (In German). INIS.

Thesis.

Differential spectra of differently radiated Ar laser beams and normal emission spectra of Ar plasmas were recorded with regard to discharge current, Ar pressure and axial magnetic field. A term scheme was carried out, and relative Einstein coefficients were determined. The interdependence between population density and discharge current proved that the upper laser levels of an Ar ion laser are usually pumped from the atomic ground state by two-electron collisions. (orig.)

19444 DETECTION OF EXCITED ATOMS FROM A PLASMA GUN. Kubo, H. (Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science); Arikawa, T. Shitsuryo Bunseki; 22: No. 2, 131-134(Jul 1974).

An attempt to detect metastable helium atoms from a plasma gun by means of detecting Auger electrons from a tungsten surface has been performed to investigate the mechanism in the interaction between a helium plasma and a helium gas target. A bunch of metastable helium atoms with a duration of about 100 μsec was observed about 150 μsec after the firing of the plasma

gun. This fact would support the previous result of spectroscopic measurements. (auth)

19445 ACCELERATION OF ELECTRONS BY ELECTROSTATIC WAVES PROPAGATING PERPENDICULAR TO A MAGNETIC FIELD. An Acceleration Mechanism for Hot Electrons Produced by a Slow Theta-Pinch. Todoroki, J.; Sato, M.; Shimizu, K. (Nihon Univ., Tokyo. Coll. of Science and Engineering). J. Phys. Soc. Jap.; 37: No. 2, 475-481(Aug 1974).

A kinetic equation is derived which describes the interaction of electrons with electrostatic waves excited in a plasma; the waves have frequencies close to the integral multiple of the electron gyrofrequency and propagate almost perpendicular to the external magnetic field. The equation is treated in a quasilinear approximation and the solution for the averaged distribution function is obtained. It tends to the solution of a diffusion equation in energy space in the asymptotic limit. The result is applied to the hot electrons produced by a slow theta-pinch, and it is shown that the observed acceleration may be explained with a moderate value of the wave amplitude. (auth)

19446 VARIATION OF ELECTRON DENSITY AND COLLISION FREQUENCY IN A TIME-DEPENDENT PLASMA MEDIUM. Varshney, S. K.; Ram, V.; Chandra, A.; Sarkar, D. C. (Aligarh Muslim Univ., India). Indian J. Radio Space Phys.; 3: No. 4, 349-352(Dec 1974).

A plasma excited by an amplitude-modulated rf electric field possesses periodically varying parameters. It has been found that these time-dependent parameters are not exactly in phase with the plasma exciting voltage but are lagging behind. The variation of electron density and collision frequency has been calculated theoretically by solving the energy balance equation. The behaviour of the density variation coefficient (α), the collision frequency variation coefficient (β) and phase angle with the modulating frequency and modulation depth of the rf exciting field have also been studied. The theoretical results obtained by this analysis are in qualitative agreement with experimental results obtained so far. (2 figs, 12 refs) (auth)

Plasma Kinetics (Experimental)

19447 (AED-CONF-75-043-023) MEASUREMENT OF Ar I AND Ar II TRANSITION PROBABILITIES IN ARC PLASMAS. Nubbemeyer, H. (Physikalisch-Technische Bundesanstalt, Berlin (F. R. Germany)). 1975. 9p. (In German). INIS.

From spring meeting of the Fachauschuesse Kurzzeitphysik and Plasma- und Gasentladungsphysik of the DPG; Duesseldorf, F. R. Germany (4 Mar 1975).

8 figs. With abstract.

In a wall-stabilized Ar arc plasma (pressure: 5×10^4 Nm^{-2} $\leq p \leq 3 \times 10^5$ Nm^{-2} (approximately 3 atm); temperature: 10^4 K $\leq T \leq 2 \times 10^4$ K; electron density: 10^{22} m^{-3} $\leq n_e \leq 5 \times 10^{23}$ m^{-3}), the transition probabilities of Ar I 430.0 nm ($A_{(nm)} = 3.84 \times 10^5$ s^{-1} ± 5%), Ar I 714.7 nm ($A_{(nm)} = 6.40 \times 10^5$ s^{-1} ± 5%), and Ar II 480.6 nm ($A_{(nm)} = 9.97 \times 10^7$ s^{-1} ± 7%) were measured side on and end on by the "optimum fit" method. The results are recommended as a basis for a set of precise $A_{(nm)}$ values for Ar. The determination of the relatively small inaccuracies of measurement of ±5% and ±7%, respectively, is discussed. The $A_{(nm)}$ values are not altered by deviations from the LTE found for $n_e < 10^{23}$ m^{-3}. The values given below for the transition probabilities already include the wing corrections of +13%. (auth)

19448 (AED-CONF-75-043-029) MEASUREMENT OF THE ξ-FUNCTION OF THE CONTINUUM RADIATION OF XENON PLASMAS UNDER HIGH PRESSURE. Stuck, D. (Physikalisch-Technische Bundesanstalt, Berlin (F. R. Germany)). 1975. 6p. (In German). INIS.

From spring meeting of the Fachausschuesse Kurzzeitphysik and Plasma- und Gasentladungsphysik of the DPG; Duesseldorf, F. R. Germany (4 Mar 1975).

2 figs.

The ξ function of xenon was determined for the spectral region between 260 nm and 800 nm in dependence of pressure and temperature. Three arc currents (i_1 = 50 amp and i_2 = 150 amp, 1 atm; i_3 = 60 amp, 10 atm) and two pressures were applied. None of the existing theories gives the correct experimental values for the whole spectral region. (GE)

19449 (JUL-1183) EXPERIMENTAL STUDIES FOR AN EXPLANATION OF THE CAUSES OF PLASMA ROTATION IN A THETA PINCH. Witulski, H. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Plasmaphysik; Bochum Univ. (F. R. Germany)). Apr 1975. 79p. (In German). INIS.

33 figs.; 2 tabs.; 37 refs.

The paper discusses mechanisms leading to theta pinch plasma rotation, describes methods of measurement of plasma rotation and compares the experimental data from a theta pinch experiment with theoretical values and values measured elsewhere. (GE)

Plasma Kinetics (Theoretical)

Refer also to abstracts 19446 and 21331.

19450 (CEA-CONF-3045) NUMERICAL SIMULATION OF NEUTRAL INJECTION ON A HOT ELECTRON MIRROR TARGET PLASMA. Gormezano, C.; Melin, G.; Werkoff, F. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de la Physique du Plasma et de la Fusion Controlee). 1975. 4p. (CONF-750905-11). Dep. NTIS (US Sales Only) $4.00.

From 7th European conference on controlled fusion and plasma physics; Lausanne, Switzerland (1 Sep 1975).

In the case of neutral injection on a hot electron target plasma, the use of the existing Fokker–Planck codes is greatly complicated by the fact that the scale of the energies of the confined ions is very large. To avoid this difficulty, a multi-species model is used in which the particle losses are described by a differential system. (auth)

19451 (CEA-CONF-3047) MULTISPECIES DIFFUSION COEFFICIENTS IN THE PFIRSCH–SCHLUTER AND BANANA REGIMES FOR ALL TEMPERATURE AND MASS RATIOS. Rolland, P.; Werkoff, F. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de la Physique du Plasma et de la Fusion Controlee). 1975. 4p. (CONF-750905-13). Dep. NTIS (US Sales Only) $4.00.

From 7th European conference on controlled fusion and plasma physics; Lausanne, Switzerland (1 Sep 1975).

A general expression for the parallel friction is straightforwardly derived by using only the fact that the Fokker–Planck operator conserves momentum. Assuming the galilean invariance of the F. P. operator, a simplified operator is obtained for unlike particle collisions, which gives the correct expression for the friction force. The inspection of the influence of the shape of the distribution function on the friction allows one to show that the fluid description of the Pfirsch–Schluter regime fails out when temperature gradients are taken into account. In the case of banana regime the results differ from those previously derived for multi species. (auth)

19452 (CEA-CONF-3048) EXPRESSIONS FOR IMPURITY IONIZATION IN TOROIDAL MAGNETIC CONFIGURATIONS. Tonon, G. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de la Physique du Plasma et de la Fusion Controlee). 1975. 4p. (CONF-750905-10). Dep. NTIS (US Sales Only) $4.00.

From 7th European conference on controlled fusion and plasma physics; Lausanne, Switzerland (1 Sep 1975).

Analytic expressions are given for the mean charge of the impurity ions, the mean charge of the plasma and the effective charge when coronal equilibrium is assumed. (auth)

19453 (CONF-750905-1) NEOCLASSICAL EQUILIBRIUM AND TRANSPORT CALCULATIONS FOR THE FULL RANGE OF COLLISIONALITY. Beasley, C. O.; McCune, J. E.; Meier, H. K.; van Rij, W. I.; Callen, J. D. (Oak Ridge National Lab., Tenn. (USA)). 1975. 4p. Dep. NTIS $4.00.

From seventh European conference on controlled fusion and plasma physics; Lausanne, Switzerland (1 Sep 1975).

The new Collisional Plasma Model, used to obtain neoclassical equilibria and transport in tori, is described. Results over the full collisionality range (banana through Pfirsch–Schlüter) show the distribution function, radial flux, bootstrap current and other important macroscopic quantities, and are compared with earlier, more approximate results. (auth)

19454 (COO-2059-47) INTEGRATION OF THE VLASOV EQUATION IN CONFIGURATION SPACE. Cheng, C. Z.; Knorr, G. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy). Jun 1975. Contract AT(11-1)-2059. 52p. Dep. NTIS $5.75.

A convenient, fast, and accurate method of solving the one-dimensional Vlasov equation numerically in configuration space is described. It treats the convective terms in the x and v directions separately and produces a scheme of second order in DELTA The resulting free-streaming and accelerating equations are computed with Fourier interpolation and spline interpolation methods respectively. The numerical method is tested with linear and nonlinear problems. The method is very accurate and efficient. A new method of smoothing the distribution function is given. It reduces the computational effort by artificially increasing the entropy of the system. As a result, the distribution function is smooth enough to be well represented on a given mesh. The

methods can be generalized in a straightforward way to deal with more complicated cases such as problems with nonperiodic spatial boundary conditions, two- and three-dimensional problems with and without external magnetic and/or electric fields. (auth)

19455 (COO-2276-6) ANNUAL PROGRESS REPORT. Rusek, A. (Connecticut Univ., Storrs (USA). Dept. of Physics). Jun 1975. Contract AT(11-1)-2276. 4p. Dep. NTIS $4.00.

Progress has been made in calculation of cross-sections for dielectronic and radiative recombination when hot electrons are incident on partially stripped impurity ions. Calculations were completed for the cases of 1 keV and 10 keV electrons incident on ions of arbitrary Z with ionization state consistent with a 1 keV plasma temperature. It was found that dielectronic recombination dominates radiative recombination by a factor of 100 at 1 keV incident electron energy to a factor of 1000 at 10 kev incident electron energy. The work is now being extended to other plasma temperatures and is being improved by more accurate calculation of the matrix elements involved. Progress was also made in the calculation of accurate bremsstrahlung and higher order radiative processes which also occur when hot electrons are incident on partially stripped impurity ions. Formal expressions for the matrix elements have been obtained for cross-sections in a fully relativistic partial wave analysis for bremsstrahlung radiation both with and without electron excitation of the target ion. Final evaluation now awaits the evaluation of the relativistic radial integrals involved in these matrix elements. (auth)

19456 (COO-2456-12) TIME DEPENDENT COMPUTER SIMULATION OF AN ELECTROMAGNETIC SHOCK TUBE. Chu, C. K. (Columbia Univ., New York (USA). Plasma Lab.). 1974. AT(11-1)-3086; AT(11-1)-2456. 6p. (CONF-750606-6). Dep. NTIS $4.00.

From seventh conference on numerical simulation of plasmas; New York, New York, USA (2 Jun 1975).

The high energy shock tube in the Columbia Plasma Physics Laboratory is an electromagnetically driven coaxial shock tube, designed to study shock-heated plasmas in regimes of fusion interest (ion temperature ~1 keV, shock speeds 4×10^6 cm/sec). The present paper summarizes the computational work devoted to this device. The purposes of these studies are (1) extending the theoretical understanding of the dynamics and physics of shock waves, particularly in more than one dimension, (2) anticipating and interpreting experimental results, and (3) determining parameters in the design of some experiments. (MOW)

19457 (COO-2456-13) CLASS OF UNCONDITIONALLY STABLE SECOND-ORDER IMPLICIT SCHEMES FOR HYPERBOLIC AND PARABOLIC EQUATIONS. Lui, H. C. (Columbia Univ., New York (USA). Plasma Lab.). [nd]. Contract AT(11-1)-2456. 4p. (CONF-750606-7). Dep. NTIS $4.00.

From seventh conference on numerical simulation of plasmas; New York, New York, USA (2 Jun 1975).

The linearized Burgers equation is considered as a model $u_t + au_x = bu_{xx}$, where the subscripts t and x denote the derivatives of the function u with respect to time t and space x; a and b are constants ($b \geq 0$). Numerical schemes for solving the equation are described that are second-order accurate, unconditionally stable, and dissipative of higher order. (auth)

19458 (COO-2456-14) NUMERICAL SOLUTION OF THE M.H.D. PLASMA EQUILIBRIUM EQUATION. Reusch, M. F. (Columbia Univ., New York (USA)). Jun 1975. 2p. (CONF-750606-4). Dep. NTIS $4.00.

From seventh conference on numerical simulation of plasmas; New York, New York, USA (2 Jun 1975).

The solution of the plasma equilibrium equation has been the subject of past interest both as a necessary prerequisite for the study of plasma stability, and in itself for the maximization of certain desirable equilibrium properties. Most previous work has neglected an obvious consequence of the nonlinearity of the problem, namely bifurcation of the solutions. Bifurcation is the possibility of the existence of more than one or no solutions at all to the problem. A simple estimate of solution multiplicity and a method for obtaining them are given. (auth)

19459 (INR-P-1457/7/PP/C) RADIATION TRANSPORT THEORY BASED ON GENERALIZED BIBERMAN-HOLSTEIN FACTOR FOR A NONTHERMAL PLASMA SLAB. Kuszell, A.; Suckewer, S. (Institute of Nuclear Research, Warsaw (Poland)). 1973. 16p. INIS.

The approximate form of the generalized Biberman-Holstein coefficients P_{nm} is obtained. The values of P_{21} averaged on solid angles are determined from averaged transport equations for radiation of two-level atomic models. In order to formulate boundary conditions it was necessary to solve the anisotropic transport equation with the source function expressed in the terms of the averaged P_{21}. (INIS)

19460 (INR-P-1458/7/PP/C) RADIATION DISTRIBUTION IN PSEUDO-THERMODYNAMIC MODEL FOR NONTHERMAL PLASMAS. Suckewer, S. (Institute of Nuclear Research, Warsaw (Poland)). 1973. 14p. INIS.

Spectral radiation distribution for nonthermal plasma is described in the frame of pseudo-thermodynamic model introducing Biberman-Holstein coefficients in general form. It was shown that the Einstein-Milne equation for radiation intensity in pseudo-thermodynamic model has a similar form as the thermodynamic equilibrium. (auth)

19461 (IPP-6/135) INVESTIGATIONS OF THE MONOTONICITY OF DIFFERENCE SCHEMES FOR DIFFUSION EQUATIONS. Steuerwald, J. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Apr 1975. 72p. (In German). Dep. NTIS (US Sales Only) $6.75.

The aim of this study is to develop a general theory of the monotonicity of difference schemes for a certain class of diffusion equations. It is shown that this problem is contained in the more comprehensive general boundary value problem for parabolic differential equations. It was thus possible to enlist and adapt the known estimates for weakly coupled systems of diffusion equations. A similar method can be applied to prove the monotonicity of strongly coupled systems of diffusion equations. To ensure its validity, the set of solutions has to be restricted. The estimates obtained were checked on a system of strongly coupled diffusion equations from plasma physics. As already discussed elsewhere in the literature, it was found that a certain amount of caution should be exercised in choosing the step sizes. (auth)

19462 (NP-20506) INSTITUTE FOR ELECTROMAGNETIC FIELD THEORY AND PLASMA PHYSICS ANNUAL REPORT, 1974. (Chalmers Tekniska Hoegskola, Goeteborg (Sweden). School of Electrical Engineering). 1974. 35p. (In Swedish and English). Dep. NTIS (US Sales Only) $4.75.

Research during this period relates to the basic aspects of nonlinear interactions in plasmas as well as to work oriented towards the applications. Project areas discussed include the following: (1) laser fusion, (2) electron beam fusion, (3) reactor development studies, (4) turbulence and anomalous effects, (5) nonlinear effects in plasmas, (6) stochastic processes and coherence in plasma, and (7) analysis of diagnostic processes. (MOW)

19463 NUMERICAL TREATMENT OF RAPID EQUIPARTITION RATES. Christiansen, J. P.; Roberts, K. V. (UKAEA Culham Lab., Abingdon, Eng.). J. Comput. Phys.; 17: No. 3, 332-339(Mar 1975).

The relevant energy equations for a two-component plasma are given. A simple method is described for accurately treating the equipartition of energy between these two components. The method is summarized while its limitations and applicability are discussed. (MOW)

19464 AXISYMMETRIC MULTIFLUID SIMULATION OF HIGH BETA PLASMAS WITH ANISOTROPIC TRANSPORT USING A MOVING FLUX COORDINATE GRID. Anderson, D. V. (Naval Research Lab., Washington, DC). J. Comput. Phys.; 17: No. 3, 246-275(Mar 1975).

A method for solving the complete set of multifluid MHD equations is given. The algorithm SLIDE, which is derived from flux-corrected transport methods, is used to solve the fluid equations on a moving 2D axisymmetric coordinate grid in which one set of grid lines represents magnetic flux surfaces while a second set is constructed orthogonally. Preservation of the diagonal form of transport tensors allows accurate representation of anisotropic transport. Results are shown for a problem in theta-pinch geometry and are contrasted to the results of a more conventional (r,z) code. (auth)

Plasma Production

Refer also to abstracts 19434 and 19486.

19465 (AED-CONF-75-043-028) TIME-RESOLVED STUDY OF LASER SPARKS. Meyer, I.; Stritzke, P. (Hamburg Univ. (F. R. Germany). Inst. fuer Angewandte Physik). 1975. 5p. (In German). INIS.

From spring meeting of the Fachausschuesse Kurzzeitphysik and Plasma- und Gasentladungspysik of the DPG; Duesseldorf, F. R. Germany (4 Mar 1975).

8 figs.

The paper reports on laser-induced spark plasmas in nitro-

gen. In addition to plasma production and plasma diffusion, the formation of plasma layers under laser influence is discussed. The existence of shock waves was proved by a Schlieren experiment. The pressure dependence of the plasma expansion velocity was also measured. (GE)

19466 (SAND-75-0369) LONG FOCAL-LENGTH TELE-MICROSCOPE FOR LASER TARGET ALIGNMENT. Cano, G. L. (Sandia Labs., Albuquerque, N. Mex. (USA)). Jul 1975. Contract AT(29-1)-789. 15p. Dep. NTIS $4.00.

An inexpensive, long focal-length optical system was developed to view microscopic targets from large distances. Measured and theoretical limits of resolution agree within 2% at 560 nm. Spheres of diameter ≳ 50 μm at 50 cm distance are clearly resolved. (auth)

19467 (UCRL-51787) CYLINDRICAL LASER TARGETS. Rinde, J. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 Jun 1975. Contract W-7405-Eng-48. 8p. Dep. NTIS $4.00.

This report summarizes the work to date on cylindrical laser targets and describes the requirements, methods of preparation, and the results achieved on the initial prototypes. (auth)

Plasma Stability

Refer also to abstract 20544.

19468 (CONF-750905-4) RESULTS FROM THE ELMO BUMPY TORUS IN A THEORETICAL CONTEXT. Hedrick, C. L.; Dandl, R. A.; Dory, R. A.; Eason, H. O.; Guest, G. E.; Haste, G. R.; Ikegami, H.; Jaeger, E. F.; Lazar, N. H.; McAlees, D. G.; McNeill, D. H.; Nelson, D. B.; Owen, L. W. (Oak Ridge National Lab., Tenn. (USA)). 1975. 4p. Dep. NTIS $4.00.

From seventh European conference on controlled fusion and plasma physics; Lausanne, Switzerland (1 Sep 1975).

Theoretical and experimental results from the ELMO Bumpy Torus are discussed with particular emphasis on macroscopic stability and transport. (auth)

19469 (CONF-750905-8) NEOCLASSICAL DIFFUSION AND DISSIPATIVE TRAPPED-ELECTRON INSTABILITIES IN THE TRANSITION FROM THE BANANA TO PLATEAU COLLISIONALITY REGIME. Callen, J. D.; Tsang, K. T. (Oak Ridge National Lab., Tenn. (USA)). 1975. 4p. Dep. NTIS $4.00.

From seventh European conference on controlled fusion and plasma physics; Lausanne, Switzerland (1 Sep 1975).

A phenomenological procedure of separating velocity space into various regions of collisionality (banana, plateau, boundary layer), calculating the perturbed distribution functions accordingly, and appropriately averaging over velocity space, is used to analytically reproduce neoclassical diffusion and facilitate investigation of dissipative trapped-electron modes in this important transition regime. (auth)

19470 (CONF-750905-9) NONLINEAR EVOLUTION OF MHD INSTABILITIES. Bateman, G.; Hicks, H. R.; Wooten, J. W.; Dory, R. A. (Oak Ridge National Lab., Tenn. (USA)). 1975. 4p. Dep. NTIS $4.00.

From seventh European conference on controlled fusion and plasma physics; Lausanne, Switzerland (1 Sep 1975).

A 3-D nonlinear MHD computer code was used to study the time evolution of internal instabilities. Velocity vortex cells are observed to persist into the nonlinear evolution. Pressure and density profiles convect around these cells for a weak localized instability, or convect into the wall for a strong instability. (auth)

19471 (COO-3237-50) THEORETICAL PLASMA PHYSICS RESEARCH. Progress Report. (Institute for Advanced Study, Princeton, N. J. (USA)). [nd]. Contract E(11-1)-3237. 5p. Dep. NTIS $4.00.

Brief discussions are given for the following topics: (1) nonlinear kink modes in tokamaks, (2) nonlinear tearing modes in tokamaks, (3) microinstabilities associated with TFTR, (4) stability of ion rings, (5) parametric instabilities, (6) high-dimensional solitons, and (7) trapped electron instability in a finite beta plasma. (MOW)

19472 (IPP-1/152) SURVEY ON THE MHD STABILITY THEORY OF AXISYMMETRIC TOROIDAL EQUILIBRIA WITH CIRCULAR AND ELONGATED PLASMA CROSS SECTIONS. Gruber, O. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Mar 1975. 33p. (In German). Dep. NTIS (US Sales Only) $4.75.

A survey of the MHD stability of axisymmetric toroidal equilibria with circular and "vertical", non-circular plasma cross-sections is given. The influence of the toroidal current density distribution, the diamagnetic poloidal currents, the plasma conductivity and the toroidal aspect ratio is discussed. A comparison of non-circular with circular cross-sections shows the same stability behavior of the internal kink modes. Furthermore, the stability of localized modes is improved if diamagnetic currents (necessary for high-β values) and D-shaped cross-sections are taken into account. Stabilization of both modes calls for a q-value on the magnetic axis of about 1. To stabilize the external kink modes, both adequate shear (vanishing current density at the plasma surface) as in a circular cross-section and small curvature at the ends of the elongated plasma cross-section are necessary. The stabilizing effect of diamagnetic poloidal currents also exists for the external modes except for the surface current model. (auth)

19473 (LA-UR-75-885) SCYLLAC "DERATED" FEEDBACK SECTOR EXPERIMENTS. Cantrell, E. L.; Ellis, W. R.; Freeman, B. L. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-ENG-36. 5p. (CONF-750905-2). Dep. NTIS $4.00.

From 7th European conference on controlled fusion and plasma physics; Lausanne, Switzerland (1 Sep 1975).

A 120° sector of the Scyllac torus was "derated" for feedback stabilization experiments to reduce the m = 1 instability growth rates to values which are compatible with the response time of the feedback system. Initial plasma studies are given and compared with the predictions of an MHD model. Plasma stabilization experiments are reported. (auth)

19474 (MATT-1067) NONLINEAR COUPLING OF KINK MODES IN TOKAMAKS. Dagazian, R. Y. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). Jul 1975. Contract AT(11-1)-3073. 62p. Dep. NTIS $6.25.

The m = 2, n = 1 kink mode is shown to be capable of destabilizing the m = 1, n = 1 internal kink. A nonlinear Lagrangian theory is developed for the coupling of modes of different pitch, and it is applied to the interaction of these modes. The coupling to the m = 2 mode provides sufficient additional destabilization to the internal mode to permit it to account even quantitatively (where it had failed when considered by itself) for many of the features of the disruptive instability. (auth)

19475 (MATT-1146) STABILIZATION OF TRAPPED PARTICLE MODES BY REVERSED GRADIENT PROFILES. Tang, W. M.; Rutherford, P. H.; Furth, H. P.; Adam, J. C. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). Jul 1975. Contract AT(11-1)-3073. 15p. Dep. NTIS $4.00.

Under certain modes of operation of very large tokamaks such as the proposed TCT (Two-Component Torus), it is possible to create oppositely directed density and temperature gradients ($\nabla n \cdot \nabla T < 0$) in the hotter central region of the plasma and the usual profile ($\nabla n \cdot \nabla T > 0$) on the colder outer edge. Such configurations are found to be very favorable to stability against trapped-particle modes. (auth)

19476 (ORNL-TM-5008) EXCITATION OF SHORT WAVELENGTH ALFVEN OSCILLATIONS BY HIGH ENERGY IONS IN TOKAMAK. Beasley, C. O. Jr.; Lominadze, J. G.; Mikhailovskii, A. B. (Oak Ridge National Lab., Tenn. (USA)). Aug 1975. Contract W-7405-eng-26. 9p. Dep. NTIS $4.00.

The excitation of Alfven waves by fast untrapped ions in axisymmetric tokamaks is described by the dispersion relation epsilon$_{11}$ - c^{2}k^2/sub parallel bars//omega^2 equals 0. Using this relation a new class of instability connected with the excitation of Alfven oscillations is described. (MOW)

19477 (UPee-73-10) THE ELEMENTARY THEORY OF PARAMETRIC INSTABILITIES IN A UNIFORM PLASMA. Brambilla, M. (Padua Univ. (Italy). Istituto di Elettrotecnica e di Elettronica). Nov 1973. 11p. INIS.

Parametric instabilities in a uniform plasma are described in terms of the interaction between two natural oscillations of the plasma under the action of an externally imposed modulation. The "universal" equations describing this kind of interaction are discussed. (INIS)

19478 PLASMA TURBULENCE GENERATED BY ION–ION TWO-STREAM INSTABILITY. Kiwamoto, Y. (Nagoya Univ. (Japan). Inst. of Plasma Physics). J. Phys. Soc. Jap.; 37: No. 2, 466–474(Aug 1974).

An instability is generated by injecting a high density ion-beam with a large cross-section into an unmagnetized homogeneous plasma. The linear dispersion relation of the wave in the ion–ion two-stream system is experimentally confirmed. Three-dimensional investigations of the turbulence thus produced reveal some new features: the turbulent waves propagate at large angles to the beam with extremely short correlation lengths. At these angles a rapid relaxation of the velocity distribution of the ions is observed until the beam temperature reaches around 0.2 Te.

The observed rapid heating of ions can be explained by a theory incorporating the effect of orbit modification. (auth)

19479 HIGH FREQUENCY ELECTROSTATIC INSTABILITIES IN A PLASMA WITH A SMALL FRACTION OF HOT ELECTRONS. Shimizu, K.; Todoroki, J.; Sato, M. (Nihon Univ., Tokyo. Coll. of Science and Engineering). J. Phys. Soc. Jap.; 37: No. 2, 460-465(Aug 1974).

The electrostatic instabilities with frequencies close to the integral multiples of the electron gyrofrequency (Ω) are considered for a plasma in a uniform magnetic field, where the plasma is composed of a small fraction of hot electrons of "loss-cone" type velocity distribution and a cold main body. The instabilities are produced as a result of the coupling between the electron-cyclotron wave of the hot electrons and the upper-hybrid mode of the cold plasma. It is found that among the hydrodynamic and the kinetic modes considered, the short wave-length hydrodynamic "flute" mode with the frequency 2Ω is the most probable one for the experimental conditions of the hot electron plasma formation in a slow theta-pinch. (auth)

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Refer also to abstracts 20382, 20383, and 21490.

19480 (ANL-8153, pp 165-174) BASIC STUDIES IN THE DEVELOPMENT OF CONTROLLED FUSION. Jan 1975.

In Chemistry Division annual report, July 1973-June 1974. (Argonne National Lab., Ill. (USA)).

Summaries of research are given for the following topics: (1) spectroscopy of relevant high temperature systems, (2) matrix-isolation spectroscopy applied to quantitative sputtering studies of niobium, (3) spectroscopic characterization of sputtered molybdenum atoms isolated in rare-gas matrices, (4) synthesis and characterization of dinitrogen complexes of niobium and platinum in noble-gas matrices; (5) dinitrogen complexes of platinum, (6) synthesis and characterization of dibenzene-metal sandwich compounds in argon matrices at 14°K, and (7) investigation of metal hydrides by neutron scattering. (MOW)

19481 (BNL-20241) PRODUCTION AND USE OF Li(d,n) NEUTRONS FOR SIMULATION OF RADIATION EFFECTS IN FUSION REACTORS. Goland, A. N.; Gurinsky, D. H.; Hendrie, J.; Kukkonen, J.; Sheehan, T.; Snead, C. L. Jr. (Brookhaven National Lab., Upton, N.Y. (USA)). 1975. 29p. (CONF-750723-3). Dep. NTIS $4.50.

From international conference on radiation test facilities for the CTR surface and materials program; Argonne Illinois, USA (15 Jul 1975).

In the Brookhaven Accelerator-Based Neutron Generator 1.5-cm thick x 12-cm wide films of lithium flowing at the velocity of approximately 10 m sec^{-1} will be the targets for 30-MeV D^+ and D^- beams 1-cm high and 10-cm wide. At this energy a beam of energetic neutrons is emitted mainly in the forward direction (theta less than or equal to 20^0) as a result of the Li(d,n) breakup reaction. Measurements of the neutron flux and spectrum as a function of incident deuteron energy and emission angle theta (theta less than or equal to 20^0) indicate that the yield increases approximately linearly with increasing deuteron energy from 25 MeV to at least 35 MeV, and that the mean energy of the neutrons (theta equals 0^0) is about 0.4 of the incident deuteron energies between 25 and 35 MeV. The most probable neutron energy in the forward-directed (theta equals 0^0) spectrum is also about 0.4 of the deuteron energy over this range. For a 30-MeV beam, the full width at half maximum of the neutron spectrum is 11.8 MeV (theta equals 0^0), and the mean neutron energy is 13 MeV. Pertinent radiation-damage parameters were calculated for various materials exposed to this neutron spectrum. In Nb, for example, the helium production rate and the displacement rate simulate the values anticipated in a D-T fusion reactor spectrum of comparable flux. Furthermore, the primary-recoil-atom energy distributions produced by Li(d,n) neutrons in Al, Nb, and Au are similar to those produced by 14-MeV neutrons. The total forward yield (theta less than or equal to 90^0) of the neutron generator will be approximately 2×10^{16} neutrons sec^{-1} for a 100-mA deuteron beam. The source cross-sectional dimensions will be variable. Peak neutron fluxes of approximately 10^{15} neutrons cm^{-2} sec^{-1} can be achieved, and the volume for fluxes over 10^{14} neutrons cm^{-2} sec^{-1} is relatively large. The neutrons can be produced in a pulsed, modulated or effectively dc mode giving complete flexibility in simulating the diverse time-dependent neutron fluxes associated with various fusion reactor concepts. (auth)

19482 (BNL-20263) PRELIMINARY DESIGN OF A 30-MEV DEUTERON LINEAR ACCELERATOR FOR THE PRODUCTION OF INTENSE BEAMS OF HIGH ENERGY NEUTRONS FOR CTR RESEARCH. Batchelor, K.; Blewett, J. P.; Chasman, R.; Claus, J.; Fewell, N.; Grand, P.; Lankshear, R.; Sheehan, J.; Witkover, R. (Brookhaven National Lab., Upton, N. Y. (USA)). 1975. 23p. (CONF-750723-4). Dep. NTIS $4.25.

From international conference on radiation test facilities for the CTR surface and materials program; Argonne, Illinois, USA (15 Jul 1975).

A deuteron linear accelerator capable of accelerating continuous 100 mA beam currents to an energy of 30 MeV and producing high energy neutrons via deuteron breakup on a liquid lithium target will be described. The facility will contain two 500-kV injectors providing D^+ and D^- beams allowing the operation of two experimental targets simultaneously. The D^+D^- beams will originate from low-emittance duoplasmatron sources, be first accelerated in single or double-gap electrostatic 500-kV accelerators, then injected into the linear accelerator for acceleration to 30 MeV. The 30-MeV linac is a drift-tube structure operating at 50 MHz and divided into eight cavities which will give the possibility to vary the final deuteron energy between 10 and 30 MeV. The deuteron beams will be transported to the targets in a 60-meter long channel designed to control the beam delivery on the target as to time structure, spot size, etc. The beam will be stopped on a flowing liquid-lithium target capable of removing the 3 megawatts of beam power produced. The target-neutron source parameters are described in the complementary paper titled: "Production and Use of Li(d,n) Neutrons for Simulation of Radiation Effects in Fusion Reactors," by A. Goland, et al. (auth)

19483 (CEA-CONF-3046) FIRST RESULTS ON PETULA TOKAMAK. Bardet, R.; Bernard, M.; Briffod, G. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de la Physique du Plasma et de la Fusion Controlee). 1975. 4p. (CONF-750905-12). Dep. NTIS (US Sales Only) $4.00.

From 7th European conference on controlled fusion and plasma physics; Lausanne, Switzerland (1 Sep 1975).

Tokamak discharges of 40 to 65 kA have been achieved in the PETULA installation using a metallic liner. Measurements of $T_e(r,t)$, $n_e(r,t)$... at 50 kA and 16 KGauss are reported. (auth)

19484 (CEA-CONF-3051) EXTRACTION OF IMPURITIES FROM A TOKAMAK. Consoli, T.; Legardeur, R.; Tonon, G. F. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de la Physique du Plasma et de la Fusion Controlee). 1975. 4p. (CONF-750905-15). Dep. NTIS (US Sales Only) $4.00.

From 7th European conference on controlled fusion and plasma physics; Lausanne, Switzerland (1 Sep 1975).

An electrodynamical divertor is described which expels the neutral atoms emitted by the wall after being ionized in the low density plasma corona surrounding the dense and hot plasma core. This divertor may be made more efficient if a low density plasma flow is maintained and controlled between the liner and the limiter by means of external plasma injectors. (auth)

19485 (CONF-750905-5) EXTENSION OF CONFINEMENT AND NEUTRAL INJECTION EXPERIMENTS IN ORMAK TO HIGHER PARAMETERS. Lyon, J. F. (Oak Ridge National Lab., Tenn. (USA)). 1975. 4p. Dep. NTIS $4.00.

From seventh European conference on controlled fusion and plasma physics; Lausanne, Switzerland (1 Sep 1975).

The ORMAK operating regime was extended to higher toroidal fields (25 kG), higher discharge currents (200 kA), and higher injection power (500 kW), resulting in improved plasma parameters. Specifically, ion heating increases approximately linearly with coinjection power. For counterinjection, ion heating efficiency increases while fast ion loss and deleterious plasma perturbations decrease with increasing discharge current. (auth)

19486 (COO-2007-59) LASER-PELLET FUSION BY ENERGY FEEDBACK TO A DIRECT NUCLEAR PUMPED AUXILIARY LASER. Wells, W. E. (Illinois Univ., Urbana (USA)). May 1975. 19p. (CONF-750531-7). Dep. NTIS $4.00.

From IEEE international conference on plasma science; Ann Arbor, Michigan, USA (14 May 1975).

A novel concept of new techniques which should expedite the design of a positive power reactor through an auxiliary laser system with excitation derived from reactions using neutrons from previous pellet implosions is described. Recently lasing has been achieved in radiation induced plasmas at two laboratories and indications of lasing or gain at two others in four different gas mixtures. The wavelengths of these lasers have ranged from 0.615mu to 3.5mu. These encouraging results have prompted the development of a simple analytic model which couples the present laser-fusion concepts to an auxiliary radiation-induced laser system.

This model allows the compounding of laser energy through the use of the thermalized neutrons from the preceeding implosion. The model is discussed and the anticipated problems of such a scheme explored. The required characteristics of the external and auxiliary neutron pumped laser are also given. (auth)

19487 (COO-2218-09) SUMMARY OF A MEETING ON NON-ELECTRICAL ENERGY EXTRACTION FROM FUSION REACTORS AT AEC GERMANTOWN HEADQUARTERS, MARCH 20, 1973. Miley, G. H. (comp.). (Illinois Univ., Urbana (USA)). 20 Jul 1973. 35p. Dep. NTIS $4.75.

The following six topics were discussed at the meeting: (1) energy forms available from the plasma, (2) materials processing, (3) hydrogen production, (4) plasma chemistry/radiation processing, (5) coherent radiation/broad-band radiation, and (6) neutron applications. Summaries are given for each topic. (MOW)

19488 (COO-3028-18) STUDIES IN FUSION REACTOR TECHNOLOGY. Progress Report, September 1, 1974–May 30, 1975. Axtmann, R. C.; Perkins, H. K.; Kuehler, C. H.; Fish, J. D. (Princeton Univ., N. J. (USA). Dept. of Chemical Engineering). 1975. Contract AT(11-1)-3028. 7p. Dep. NTIS $4.00.

An H^+ ion accelerator for use in materials damage studies and radiolysis experiments has been placed into operation and tested from 5 to 40 kV. A target assembly for the accelerator has been designed and partially fabricated; a gas permeation apparatus which will be integrated with the target, is ready for assembly. A reaction vessel for radiolysis studies of hydrogen gas production from water vapor has also been assembled and tested. A new type of thin (less than 2000 A of aluminum) window, which will permit passage of H^+ ions from the accelerator to the reaction vessel, has been fabricated and tested at differential pressures as high as 100 torr. Thermal gas permeation studies indicate that at driving pressures between 10^{-4} and 10^{-2} torr and temperatures between 600-700°C, the permeation rate of hydrogen gas through stainless steel is proportional to the driving pressure. Previous studies (by others) at driving pressures greater than 0.1 torr display a dependence on the square root of the pressure. Molybdenum and tungsten coatings were found on samples cut from the ST Tokamak's inner vacuum wall by means of scanning electron microscopy and energy-dispersive x-ray analysis. (auth)

19489 (ERDA-tr-50) CHEMICAL ATOMIZATION OF GRAPHITE BY H^+ IONS. Busharov, I. P.; Gorbatov, E. A.; Gusev, V. M.; Guseva, M. I.; Martynenko, Yu. V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1975. Translation of Khimicheskoe raspylenie grafita ionami H^+. 10p. Dep. NTIS $4.00.

A simple model of the mechanism of chemical atomization is given, on whose basis a decrease in chemical atomization is qualitatively predicted for high temperatures. Mass spectrometric investigations of the atomization products cited, which found CH_4 and CH_3 molecules during the irradiation of graphite and H^+ ions thereby confirmed the presence of chemical atomization. A relationship of S and temperature of graphite T during irradiation was obtained which showed a decrease in the coefficient of atomization of a high temperature. (MOW)

19490 (IPP-4/130) PRELIMINARY MODEL FOR ESTIMATING THE FIRST WALL LIFETIME OF A FUSION REACTOR. Daenner, W. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Feb 1975. 58p. Dep. NTIS (US Sales Only) $6.00.

The estimation of the first wall lifetime is a necessary basis for predicting the availability of a fusion power plant. In order to do this, an analytical model was prepared and programmed for the computer which calculates the temperature and stress load of the first wall from the principal design parameters and quotes them against the relevant material properties. Neither the analytical model nor the information about the material performance is yet complete so that the answers obtained from the program are very preliminary. This situation is underlined by the results of sample calculations performed for the CTRD blanket module cell. The results obtained for vanadium and vanadium alloys show a strong dependence of the lifetime on the irradiation creep and the ductility of these materials. Completion of this model is envisaged as soon as the missing information becomes available. (auth)

19491 (JAERI-M-5888) ANNUAL REPORT OF THERMONUCLEAR FUSION LABORATORY. For the Period of April 1, 1973 to March 31, 1974. (Japan Atomic Energy Research Inst., Tokyo). Oct 1974. 106p. INIS.

Activities in the Thermonuclear Fusion Laboratory for the period April 1973–March 1974 are described. (1) At the end of June 1973, the JFT-1 was shut down after four years of successful operation. (2) A preliminary experiment with a dynamic limiter and experiments with an improved diagnostic system were carried out with the JET-2, which started operation in the preceding year. Power-up of the generator for the toroidal coil for the JFT-2 phase-II experiment was started. (3) Construction of the JFT-2a (a tokamak of teardrop cross-section with an axisymmetric divertor) continued. (4) Further heating of tokamak plasma with neutral beam injection, the energy loss by impurities in plasma and stability of plasma were studied theoretically. (5) A concept of the JT-60 (a tokamak confining a plasma of nearly reactor conditions) was developed and its design was started. (6) Design study of a fusion reactor was carried out in order to clarify the problems on fusion reactor development. (auth)

19492 (LA-6032-MS) LTPF: A LINEAR THETA-PINCH NEUTRON SOURCE. Ellis, W. R. (Los Alamos Scientific Lab., N. Mex. (USA)). Jul 1975. 44p. Dep. NTIS $4.00.

The linear theta pinch is optimized with respect to maximum neutron current on a sample located between the discharge tube and the compression coil wall. Emphasis throughout is placed on physics and technology considerations which govern the choice of parameters. Technological demands are (hopefully) kept to a minimum. Two "point designs" are developed which are distinguished by their compressional magnetic field (i.e., coil current) wave-forms: one is sinusoidal and continuous, the other trapezoidal and pulsed intermittently. Both point designs give an average neutron current of approximately 5×10^{13} n/cm^2/s. Both devices are characterized by short lengths (approximately 1 m), rapid cycling (2 to 30 kHz), and magnetic mirrors (2 to 5:1) at the ends. A crucial item is the power supply, which is discussed in detail. (auth)

19493 (LA-UR-75-736) ENGINEERING CONCEPTS FOR LASER-FUSION REACTOR APPLICATIONS. Booth, L. A.; Frank, T. G.; Finch, F. T. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-ENG-36. 18p. (CONF-750812-2). Dep. NTIS $4.00.

From 10th intersociety energy conversion engineering conference; Newark, Delaware, USA (17 Aug 1975).

The long-range potential goal of the ERDA Laser Fusion Program is the production of commercial electric power. Although the scientific feasibility of significant thermonuclear energy release from laser imploded and heated pellets remains to be demonstrated, significant progress has been made toward this goal and many technological problems associated with ultimate applications of laser fusion are being investigated. Preliminary evaluations of several laser fusion reactor concepts have been made, and detailed studies of the most promising concepts, employing different methods for protecting structural components from damage by the products of fusion-pellet microexplosions, are being done. Engineering design and feasibility studies are also being done of other electric generating station subsystems. Overall economic and technology tradeoff studies are being done to assess the economic potential of various generating station concepts and to provide guidance for research and development programs. (auth)

19494 (LA-UR-75-864) STABILITY AND TEMPERATURE MEASUREMENTS ON ZT-1. Baker, D. A.; Burkhardt, L. C.; Di Marco, J. N. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-ENG-36. 5p. (CONF-750905-3). Dep. NTIS $4.00.

From 7th European conference on controlled fusion and plasma physics; Lausanne, Switzerland (1 Sep 1975).

Analysis of the magnetic field profiles set up in the ZT-1 pinched plasma, demonstrated that the degradation of the stability of these profiles with time, can be attributed to diffusion. Ion temperature measurements of Doppler broadened He II have determined its scaling over a range of both I_z and $\dot{I}_z$. (auth)

19495 (LA-UR-75-1032) ELECTRICAL BREAKDOWN AND TRACKING CHARACTERISTICS OF PULSED HIGH VOLTAGES IN CRYOGENIC HELIUM AND NITROGEN. Haarman, R. A.; Williamson, K. D. Jr. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-ENG-36. 16p. (CONF-750716-7). Dep. NTIS $4.00.

From international cryogenic materials conference; Kingston, Ontario, Canada (22 Jul 1975).

The proposed Scyllac Fusion Test Reactor (SFTR) at the Los Alamos Scientific Laboratory (LASL) anticipates using superconducting coils as the main energy storage device and will store a total energy of 400 MJ. The SFTR will operate in a pulsed mode with the superconducting energy storage system—METS (Magnetic Energy Transfer System)—experiencing a 60 kV pulsed voltage during each pulsed operation. This paper presents experimental data for use by engineers in the design of cryogenic apparatus that will be subject to the SFTR 60 kV pulsed waveform. Various electrode configurations were used in order to provide

the designer with the most commonly used geometries over the widest practical range of helium and nitrogen temperatures from liquid to room temperature at pressures of 0.9 and 1.6 atm. Data are also presented on voltage tracking characteristics of Mylar, phenolic, polyethylene, nylon, teflon, and permali, which are commonly used structural dielectric materials. (auth)

19496 (MATT-1149) MHD THEORY OF DIVERTORS WITHOUT VISCOSITY. Boozer, A. H. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). Jul 1975. Contract AT(11-1)-3073. 32p. Dep. NTIS $4.75.

A simple model of a divertor is studied with the classical two-fluid MHD equations. The ion temperature is assumed zero, which has the simplifying effect of giving zero ion viscosity. The electrons are shown to leave the divertor much closer to the main body of the plasma than the ions. The divertor width is found comparable to the ion gyroradius calculated with the electron temperature, which is substantially wider than some classical estimates. (auth)

19497 (ORNL-5025, pp 230-234) HIGH-INTENSITY NEUTRON SOURCE. Saltmarsh, M. J.; Smith, G. J. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

A d + Be neutron source (2×10^{12} neutrons cm^{-2} sec^{-1}) is described. Foil dosimetry and time-of-flight measurements were made to characterize the high-energy portions (E/sub n/ equal to or greater than 1 MeV) of the neutron beam, and samples were irradiated up to fluences of 2×10^{17} neutrons/cm^2. The experimental facility is described. (MOW)

19498 (ORNL-TM-4818) MAGNETOHYDRODYNAMICS TEST OF A ONE-SIXTH SCALE MODEL OF A CTR RECIRCULATING LITHIUM BLANKET. Young, F. J.; Holcomb, R. S.; Fraas, A. P. (Oak Ridge National Lab., Tenn. (USA)). Aug 1975. Contract W-7405-eng-26. 53p. Dep. NTIS $5.75.

A one-sixth scale model of an element of a recirculating lithium blanket for a fusion reactor was tested experimentally. The scale model was instrumented to measure flow, pressure drop and pumping power as functions of the applied magnetic field (0 to 4 T) and the pump current (0 to 300 amp dc). Reynolds numbers as high as 22,000, magnetic Reynolds numbers up to 0.047 and a maximum Hartmann number of 12,000 were obtained with a wall-to-fluid conductivity ratio of 0.0158. The ratio of loop pressure drop to fluid (NaK 44) velocity increased as a quadratic function of the magnetic field. The square term was dominant for the higher values of magnetic field and is predictable by simple laminar magnetohydrodynamic theory. For any given velocity and magnetic field the pressure drop in the field-flow-aligned legs of the loop is much greater than it would be in ordinary hydrodynamic flow, but nevertheless is more than an order of magnitude less than the pressure drop encountered when the fluid flows across the magnetic field. The pumping power was measured as a function of magnetic field and fluid velocity. For fields greater than 1 T and velocities exceeding 1 cm/sec the pumping power varied as the square of the product of the fluid velocity and the magnetic field. The measured value of the proportionality factor agrees with predictions based on certain simplifying assumptions. The extrapolation of these experimental results to a full scale recirculating lithium blanket indicates that no excessive pressure or pumping power is likely to result unless a drastic change in flow regime occurs as the MHD parameters are increased. There appears to be no reason to expect any such drastic change. (auth)

19499 (ORNL-TM-4941) RESEARCH PROGRAM FOR PLASMA CONFINEMENT AND HEATING IN ELMO BUMPY TORUS DEVICES. Dandl, R. A.; Dory, R. A.; Eason, H. O. (Oak Ridge National Lab., Tenn. (USA)). Jun 1975. Contract W-7405-eng-26. 155p. Dep. NTIS $10.75.

A sequence of experimental devices and related research activities which leads progressively toward an attractive full-scale reactor is described. The implementation of the steps in this sequence hinges on the development of microwave power sources, with high specific power levels, at millimeter wavelengths. Two proposed steps in this sequence are described. The first step proposed here, denoted EBT-S, requires increasing the EBT magnetic field to permit microwave heating at 18 and 28 GHz as compared to the present 10.6 and 18-GHz configuration. A three-fold increase in plasma density, some increase in the temperatures, and an opportunity to test the validity of the transport models presently used to predict the plasma parameters are anticipated. This step will provide important operating experience with the 28-GHz power supplies, which are prototype tubes for millimeter sources at 120 GHz. In the second step a new, superconducting bumpy torus, EBT-II, would be fabricated to permit microwave heating at 90 and 120 GHz. This device would be designed to produce plasma densities and temperatures comparable to those of present-day tokamaks. This report reviews the experimental and theoretical research on EBT that has been carried out to date or formulated for the near future, and provides a status report as well as a research program plan. (auth)

19500 (ORNL-tr-2988) FIRST STARTUP OF THE SIEMENS SL PROTOTYPE MAGNETS W VII IN THE IPP. Amenda, W.; Kullmann, D.; Krueger, P.; Pillsticker, M. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany). Experimentelle Plasmaphysik 4). Aug 1974. Translation by R. G. Mansfield of IPP-4/120. 15p. Dep. NTIS $4.00.

The first test results with a big superconductive prototype coil developed for the Garching Stellarator W VII are reported. Flux jumping at low currents did not start quenching. The critical current of the Nb-Ti coil reaches 91 percent of the short sample value. The stored energy at quenching is 1.83 MJ and the maximum value of the magnetic field in the winding region is 61.5 kG. The mechanical stresses did not damage the windings. Degradation was not observed. A training of the coil was not necessary. Altogether the test was successful, as important technical problems were satisfactorily solved. Only parts of cryogenic systems should be improved in order to reduce the helium losses. (auth)

19501 (SAND-75-5537) TARGET IRRADIATION STUDIES USING RELATIVISTIC ELECTRON BEAMS. Clauser, M. J.; Freeman, J. R.; Hadley, G. R.; Halbleib, J. A.; Kelly, J. G.; Kuswa, G. W.; Miller, P. A.; Mix, L. P.; Perry, F. C.; Poukey, J. W.; Shope, S. L.; Swain, D. W.; Toepfer, A. J.; VanDevender, W. H.; Widner, M. M.; Wright, T. P.; Yonas, G.; Chang, J. (Sandia Labs., Livermore, Calif. (USA)). 1975. 7p. (CONF-750905-7). Dep. NTIS $4.00.

From seventh European conference on controlled fusion and plasma physics; Lausanne, Switzerland (1 Sep 1975).

Recent experiments are discussed in which hemispherical and spherical, high density targets were irradiated using a single relativistic electron beam. It is found that a substantial portion of the beam energy is incident on the target and that the deposition symmetry is, in some cases, quite uniform. (auth)

19502 (UCID-77021) TEST RESULTS OF A 27 CM BORE MULTIFILAMENTARY Nb_3Sn SOLENOID. Zbasnik, J. P.; Nelson, R. L.; Cornish, D. N.; Taylor, C. E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 17 Jul 1975. 14p. (CONF-750710-4). Dep. NTIS $4.00.

From international cryogenics materials conference; Ontario, Canada (Jul 1975).

A coil was constructed from a large, high current prereacted multifilamentary Nb_3Sn superconductor manufactured using the bronze method. The estimated bending strain during the winding was 0.6%. The coil performed to the short sample limit. This successful test demonstrates the potential feasibility of using multifilamentary Nb_3Sn, and perhaps other brittle A15-type superconductors in the construction of large, high field magnets. (auth)

19503 (UCRL-13640(App.)) LASER FUSION SYSTEMS DESIGN STUDY. Final Technical Report. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Jun 1975. 172p. Dep. NTIS $11.75.

Complete design specifications are given for the laser fusion research program. Data on the laser, lens system, target vidicons, alignment system, and the lens mount system are given. (MOW)

19504 (UCRL-51749) STUDIES OF RADIATION BLISTERING EFFECTS ON VOLTAGE HOLDING. Miley, G. H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 31 Mar 1975. Contract W-7405-Eng-48. 44p. Dep. NTIS $4.00.

The surfaces of niobium and tungsten wires were blistered by 300-keV helium-ion irradiation and then tested for voltage holding. A cylindrical projection-tube technique was employed so that regions of strong electron emission could be observed and later examined with a scanning electron microscope (SEM). Blistering was found to cause significant increases in pre-breakdown currents. However, these currents tend to saturate over a region corresponding to around 200-400 kV/cm surface field such that the ultimate voltage breakdown limit is not seriously reduced. Emission image observations and SEM photographs suggest that, in many cases, parts of the blistered surface are gradually erected by the strong surface fields, but this may not occur until after several arc breakdowns. SEM photographs also indicate that vapor from the anode may play an important part in the breakdown mechanism. Implications of these results to the design of devices important to fusion development, such as direct collectors and ion sources, are briefly discussed. The importance of future in situ irradiation-voltage experiments is also stressed. (auth)

19505 (UCRL-76562) COMPUTER APPLICATIONS IN CONTROLLED FUSION RESEARCH. Killeen, J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Feb 1975. 23p. (CONF-750808-1). Dep. NTIS $4.25.

From national topical meeting of the ANS on nuclear engineering education; University Park, Pennsylvania, USA (18 Aug 1975).

The role of Nuclear Engineering Education in the application of computers to controlled fusion research can be a very important one. In the near future the use of computers in the numerical modelling of fusion systems should increase substantially. A recent study group has identified five categories of computational models to study the physics of magnetically confined plasmas. A comparable number of types of models for engineering studies are called for. The development and application of computer codes to implement these models is a vital step in reaching the goal of fusion power. In order to meet the needs of the fusion program the National CTR Computer Center has been established at the Lawrence Livermore Laboratory. A large central computing facility is linked to smaller computing centers at each of the major CTR laboratories by a communications network. The crucial element that is needed for success is trained personnel. The number of people with knowledge of plasma science and engineering that are trained in numerical methods and computer science is quite small, and must be increased substantially in the next few years. Nuclear Engineering departments should encourage students to enter this field and provide the necessary courses and research programs in fusion computing. (auth)

19506 (UCRL-76896) REPETITIVELY PULSED MATERIAL TESTING FACILITY. Zucker, O.; Bostick, W.; Gullickson, R.; Long, J.; Luce, J.; Sahlin, H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 12 Aug 1975. 20p. (CONF-750518-3). Dep. NTIS $4.00.

From 3rd European IRPA congress; Amsterdam, Netherlands (13 May 1975).

A continuously operated, 1 pps, dense-plasma-focus device capable of delivering a minimum of 10^{15} neutrons per pulse for material testing purposes is described. Moderate scaling from existing results is sufficient to provide 2×10^{13} n/cm^2·s to a suitable target. The average power consumption, which has become a major issue as a result of the energy crisis, is analyzed with respect to other plasma devices and is shown to be highly favorable. A novel approach to the capacitor bank and switch design allowing repetitive operation is discussed. (auth)

19507 LASER DRIVEN COMPRESSION TYPE CHAIN REACTION MICROFUSION. Kaliski, S. (Inst. of Fundamental Technological Research, Warsaw). Bull. Acad. Pol. Sci., Ser. Sci. Tech.; 22: No. 12, 1087-1094(1974).

On the basis of approximate appraisals of the critical mass of a D-T ball (which is almost the same for the chain reaction and the thermonuclear reaction) it has been shown that such a process, sufficiently effective is possible if the critical conditions of compression for a degenerate gas are satisfied ($K > 5 \times 10^4$). Under critical conditions the chain reaction process begins with a delay of some picoseconds the possibility of occurrence of an effective chain reaction being real until the plasma is thermalized and expanded (about 10^{-11} sec). To draw more certain and accurate conclusions the rough analysis must be replaced by a more detailed quantitative analysis. Some of these methods will be considered in further studies. (auth)

19508 FUSION REACTOR PROGRAM. Technol.-Nachr. Progr.-Inform.; No. 98, 10-15(1974). (In German).

A concept study and corresponding practicability experiments on some of the problems connected with the fusion reactor which Ispra can undertake on the strength of its know-how are outlined. (GE)

19509 JET: POISED FOR TAKE OFF. Rebut, P. H. (UKAEA Research Group, Abingdon, Eng.). Phys. Bull. (London); 26: 264-265(Jun 1975).

The main aim of the JET (joint European torus) experiment is to define the minimum size required for a reactor or, more precisely, to answer the question of the losses which govern the plasma energy balance, and the problem of the nature of the first wall surface. JET will also test the methods of auxiliary heating needed to reach ignition. Technical difficulties are outlined. At present a design of the apparatus itself exists but a lot of detailed studies are needed to finalize the project. (UK)

19510 APPROACHES TOWARDS CONTROLLED THERMONUCLEAR FUSION. Wobig, H. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Naturwissenschaften; 61: No. 3, 97-106(Mar 1974). (In German).

7 figs.; 4 tabs.; 52 refs.

This paper gives a general description of various approaches towards controlled thermonuclear fusion. The physical principles of the main lines: laser fusion, toroidal confinement and mirror machines are described. A summary of the latest experimental results is included. (auth)

19511 APPLICATION OF THE FUSION REACTOR IN POWER STATIONS. Darvas, J. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorentwicklung). Elektrotech. Z., A; 96: No. 1, 29-34(1975). (In German).

6 figs.; 7 refs.

The generation of power from a reacting D-T plasma is expected to be proven in the near future, hence the design of the fusion reactor is receiving growing attention. Present ideas on reactor design are discussed for the TOKAMAK and for laser fusion, emphasizing the need for an extensive development in the technology area. The conclusion is drawn that the intrinsic nuclear safety of the fusion reactor, the large reserve of deuterium and of lithium, and – last not least – the prospect for diversification of the energy prime resources in a nuclear powered energy market seem to justify the risks of a long-term development. (GE)

19512 NEW COMPUTER TECHNIQUE FOR NONLINEAR OPTICAL PROBLEMS. Elliott, C. J.; Henderson, D. B. (Los Alamos Scientific Lab., NM). J. Appl. Phys.; 46: No. 1, 354-361(Jan 1975).

The propagation of high-intensity or high-power laser pulses presents a variety of nonlinear optical problems requiring self-consistent study. Our method treats arbitrary three-dimensional problems with unlimited phase distortion and is similar to the particle-in-cell (PIC) methods of hydrodynamics and electromagnetic plasma simulation. Our numerical algorithm is based on Maxwell's equations and is applied to laser-fusion reactor and laser amplifier problems. (auth)

19513 PROSPECTS FOR DEVELOPMENT OF NUCLEAR FUSION REACTORS. Yoshikawa, S. (Tokyo Univ. (Japan)). At. Jap.; 18: No. 4, suppl., 107-120(Apr 1974).

From 7th annual conference of the Japan Atomic Industrial Forum; Tokyo, Japan (5 Mar 1974).

If controlled nuclear fusion can be brought to success, it means the self-sufficiency of energy for all people, and is especially significant for Japan. Its many advantages over nuclear fission power justify the research and development. The relation of plasma density and confinement time is first explained concerning two regions, i.e. very low density and high density. Over the world, the emphasis in research and development is placed on low-beta torus, Tokamak device in particular. World developments in this field are reviewed at length. In Japan, the national project, first five-year program, is proceeding. Nuclear fusion reactors are bound to be a future energy source, though fraught with many difficulties. (JA)

19514 DISCHARGE CLEANING IN JFT-2. Fujisawa, N.; Toi, K.; Matoba, T.; Kasai, S. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment); Sugawara, T. Jap. J. Appl. Phys.; 13: No. 5, 851-854(May 1974).

High efficiency discharge cleaning has been demonstrated for a tokamak-type apparatus. Though the repetition interval of discharge was unusually long, longer than the pumping-out time, the present method is effective in removing impurities from surfaces because of large current fed in each shot. Hydrocarbons were observed to be produced in the hydrogen gas in association with the discharge. (auth)

19515 CURRENT CONTACT OF ALUMINUM ALLOY. Shimada, T.; Kiyama, S. (Electrotechnical Lab., Tanashi, Tokyo (Japan). Tanashi Branch). Denshi Gijutsu Sogo Kenkyusho Iho; 38: No. 3-5, 173-176(Jul 1974). (In Japanese).

For the use of coils and collectors made of aluminum alloys for large pinch type fusion experimental apparatus, the binding method, binding torque needed and the current capacity of the contact of aluminum alloys have been studied with the aim of realizing a current contact capable of flowing more than 150kA in a short rise time of not more than 3μ sec without accompanying any arcing. It has been found possible to flow 183 kA/144mm^2 with the binding torque of 150 to 200kg-cm by making use of the contact piece made of indium. Consequently theta coils to produce satisfactory toroidal fields for the ETL TPE-1, a toroidal pinch device, have been successfully designed and constructed. (auth)

19516 A MAGNETIC FIELD DUE TO A TOROIDAL CURRENT. Kito, M.; Takeda, S. (Electrotechnical Lab., Tanashi, Tokyo (Japan). Tanashi Branch); Homma, T. Denshi Gijutsu Sogo Kenkyusho Iho; 38: No. 3-5, 177-209(Jul 1974). (In Japanese).

When currents flow on the surface of air ideally conducting torus (perfectly conducting toroidal plasma) in the direction of the major circumference, a magnetic field due to the currents is analytically solved. The toroidal coordinates are used in place of the Cartitian or the cylindrical coordinates. The solution of the magnetic field consists of a series of toroidal functions, $P^1_{s-\frac{1}{2}}(z)$ and $Q^1_{s-\frac{1}{2}}(z)$. The toroidal functions are numerically calculated and tabulated. If the currents are covered with a toroidal metal wall, it gives a boundary value problem. The problem is solved and a recurrent formula of the solution is obtained. The formula is

effective in making a numerical calculation of the solution. The result shows that if there is no metal wall, the current density around the inner circumference is much higher than the one around the outer one. However, the difference of the current density between the inner circumference and the outer one is decreased by the metal wall. Furthermore, if the current flows nearer to the metal wall around the outer circumference, the current density around the inner circumference is lower than the one around the outer one. A more complicated magnetic field is calculated in the presence of the toroidal theta-pinch currents. (auth)

Wave Phenomena

Refer also to abstract 20756.

19517 (CEA-CONF-3050) FILAMENTATION INSTABILITY OF AN ION–SOUND WAVE. Canobbio, E. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de la Physique du Plasma et de la Fusion Controlee). 1975. 4p. (CONF-750905-14). Dep. NTIS (US Sales Only) $4.00.

From 7th European conference on controlled fusion and plasma physics; Lausanne, Switzerland (1 Sep 1975).

Ion-sound waves propagating in a non-isothermal unmagnetized homogeneous plasma are unstable against modulation in the direction perpendicular to their propagation for all amplitudes. The relevance of this and other more general instabilities from the viewpoint of plasma heating and confinement is briefly discussed. (auth)

19518 (IPF-74-2) DETERMINATION AND NUMERICAL SOLUTION OF THE DISPERSION EQUATION FOR CYLINDRICAL DENSITY WAVES AND POTENTIAL IN THE POSITIVE COLUMN OF A GAS DISCHARGE IN AN AXIAL MAGNETIC FIELD WITH THE HELP OF GALERKIN'S METHOD. Moser, F. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Plasmaforschung). 1974. 66p. (In German). INIS.

12 figs.; 19 refs. Available from ZAED.

The paper investigates the stability of cylindrical density and potential waves with the azimuthal mode m = 1 which propagate in the positive column of a diffusion-determined plasma in an axial magnetic field. The basic equation system of the three-liquid theory is used to formulate equations suitable for studies of drift-dissipative wave phenomena. In its most general form, the dispersion equation is derived as a two-fold infinite determinant with a perturbation approach for density and potential. This means that the system of two normal second-order differential equations for the radius-dependent amplitude functions of density and potential waves is solved with Galerkin's approximation method. With the proper choice of coordinate functions for Galerkin's approach, good results can be derived with only a few terms. The first approximation of the dispersion equation is used for the numerical solution of a definite example. Explicit functional dependences of the axial wave number K can then be given for the increasing amplitude and the oscillation frequency of the cylindrical waves. (GE)

19519 (IPF-74-4) EXPERIMENTS WITH TORSIONAL ALFVEN WAVES IN INHOMOGENEOUS, AXIALLY SYMMETRIC MAGNETIC FIELDS. Schueller, P. G. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Plasmaforschung). 1974. 66p. (In German). INIS.

28 figs.; 42 refs.

The propagation properties of Alfven torsion waves in spatially inhomogeneous magnetic fields with axial symmetry were studied in experiments and compared with numerical calculations. The experiments were carried out in a hydrogen plasma with superposed axially symmetric magnetic fields with different spatial configurations. An additional magnetic field coil was used to increase or diminish magnetic induction in axial direction or to give it a spatially periodic structure. Alfven torsion waves were stimulated in pulsed manner by a coaxial antenna system at the anode. The wave fields were measured with magnetic probes, and a numerical fourier analysis of the probe signals was carried out. Studies of wave propagation in a spatially periodic magnetic field always show a spatial amplification of the wave to which the spatially parametric resonance condition applies. For a better correspondence between experimental and numerical results in this case, the calculations have to be elaborated as in the present study. (auth)

19520 (IPP-2/228) RESONANCE CONES OF ELECTRON PLASMA WAVES IN TOROIDAL, INHOMOGENEOUS PLASMAS. Javel, P.; Mueller, G.; Weber, U.; Weynants, R. R. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Mar 1975. 18p. Dep. NTIS (US Sales Only) $4.00.

The resonance cones of electron plasma waves, their trajectory and the related wave dispersion are observed and confirmed under the combined influence of toroidicity, strong inhomogeneity and energy depletion by ionization and heating up to close to the lower hybrid density. The fine structure within the cone typical for finite length exciters is also verified. (auth)

19521 (IPP-IV-82) COUPLING AND ABSORPTION OF LOWER-HYBRID WAVES IN A THERMONUCLEAR PLASMA. Puri, S.; Tutter, M. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Mar 1975. 84p. Dep. NTIS (US Sales Only) $7.25.

The three important aspects, namely (i) accessibility, (ii) matching and (iii) absorption of the lower-hybrid waves in a thermonuclear plasma are studied under idealized but physically pertinent conditions within the framework of linearized theory. After two successive linear mode conversions—from an electromagnetic to a plasma wave and from the plasma to an electrostatic wave, respectively—the energy of the wave is deposited into the plasma ions in the presence of magnetic field gradients. (auth)

19522 PLANE HOMOTHERMAL SHOCK-WAVE IN A HALF-SPACE OF AN IDEAL GAS. Kaliski, S. (Inst. of Fundamental Technological Research, Warsaw). Bull. Acad. Pol. Sci., Ser. Sci. Tech.; 22: No. 12, 1025-1031(1974).

A solution is given to the plane boundary-value problem for a homothermal shock-wave in perfect gas. The problem is solved in quadratures which can be integrated in special cases in an elementary manner. The paper is important for the analysis of several particular variations of laser thermonuclear microfusion. In the case of nonelementary quadratures solution can be obtained by relatively simple computation. The present paper constitutes a point of departure for the analysis of more complex problems of the homothermal shock-wave, the concentric shock-wave, in particular, for the cases, in which homothermal approximation is justified. (auth)

19523 CONCENTRIC HOMOTHERMAL SHOCK IN A SPHERICAL GAS BALL. Jach, K.; Kaliski, S. (Inst. of Fundamental Technological Research, Warsaw). Bull. Acad. Pol. Sci., Ser. Sci. Tech.; 22: No. 12, 1017-1024(1974).

Some particular solutions are given for a concentric homothermal shock-wave generated in a spherical ball of perfect gas. They are found in quadratures or by reducing the problem to that of integrating a nonlinear ordinary differential equation. A solution in quadratures is obtained in the asymptotic case. The reduction of the problem to that of integrating an ordinary differential equation is achieved in cases in which the variable can be separated. In addition to their importance as solutions of a separate problem, these solutions are interesting as a means of verification of various approximate methods. (auth)

19524 REFLECTION AND TRANSMISSION OF ION ACOUSTIC WAVES FROM A PLASMA DISCONTINUITY. Gary, S. P. (Coll. of William and Mary, Williamsburg, VA); Alexeff, I.; Bloomberg, H. W. IEEE Trans. Plasma Sci.; PS-3: No. 2, 46-48(Jun 1975).

Transmission and reflection coefficients are calculated for an ion acoustic wave incident from the upstream direction upon a plasma discontinuity of width much less than the wavelength. In the limit of an infinitely strong discontinuity there is complete in phase reflection. (auth)

19525 RELATIVISTIC PLASMA DISPERSION FUNCTION. Godfrey, B. B.; Newberger, B. S.; Taggart, K. A. (Los Alamos Scientific Lab., NM). IEEE Trans. Plasma Sci.; PS-3: No. 2, 60-67(Jun 1975).

A relativistic plasma dispersion function is defined, and its analytic properties discussed. Using this function, it should prove possible to formulate relativistic plasma linear theory in a particularly simple form for study either analytically or numerically. As an example, the dispersion relation for Langmuir waves in a one-dimensional relativistic plasma is solved and compared against the results of computer simulations. Agreement is good for waves of phase velocity either above or below the speed of light. Two appendixes are provided, the first giving several expansions and other representations of the dispersion function, the second discussing numerical methods for its evaluation. Contour plots of the function are included. (auth)

19526 RELATIVISTIC LINEAR THEORY IN THE ABSENCE OF EXTERNAL FIELDS. Godfrey, B. B.; Newberger, B. S.; Taggart, K. A. (Los Alamos Scientific Lab., NM). IEEE Trans. Plasma Sci.; PS-3: No. 2, 68-75(Jun 1975).

The dielectric tensor for a multi-component, homogeneous, field-free relativistic plasma is derived in manifestly covariant form. From the dielectric tensor, linear dispersion relations are obtained explicitly when each component of the plasma is isotropic in its rest frame. If the components are relativistic

Maxwellians, these dispersion relations are expressible in terms of the relativistic plasma dispersion function. Special attention is given to the Weible and two-stream instabilities and to the normal modes of a quiescent, hot electron gas. For the last case the dispersion relations are solved numerically and compared against computer simulation data. An appendix applies the formalism to cold plasmas. (auth)

19527 REFLECTION AND TRANSMISSION OF EXTRAORDINARY WAVES IN AN INHOMOGENEOUS MAGNETIZED PLASMA. I. Infinite Plasma. Tang, T. W. (Univ. of Massachusetts, Amherst); Wong, K. C.; Caron, P. R. IEEE Trans. Plasma Sci.; PS-3: No. 2, 76-81(Jun 1975).

By retaining higher order terms in analysis, a more accurate expression for the reflection and transmission coefficients for an extraordinary wave propagating perpendicular to a static magnetic field through an infinite warm plasma is obtained. The result is compared with previous analytical and numerical results, the latter obtained by an integral equation method. In addition to occurring at resonances, the total reflection of the extraordinary wave is shown to also occur at anti-resonances with a standing wave of larger amplitude. (auth)

19528 REFLECTION AND TRANSMISSION OF EXTRAORDINARY WAVES IN AN INHOMOGENEOUS MAGNETIZED PLASMA. II. Thin Plasma Slab. Tang, T. W.; Wong, K. C. (Univ. of Massachusetts, Amherst). IEEE Trans. Plasma Sci.; PS-3: No. 2, 82-87(Jun 1975).

A more accurate analytical expression for the reflection and transmission coefficients of an extraordinary wave incident upon a thin finite plasma slab perpendicular to a static magnetic field is obtained. The analytical result is compared with that obtained by the numerical method and with that of earlier experimental observations. The effect of small collisional damping on mode conversion, particularly at anti-resonance is also discussed. (auth)

19529 COLD PLASMA OSCILLATIONS: AN EXACT SOLUTION OF THE NONLINEAR EQUATIONS. Chu, P. L.; Karbowiak, A. E. (Univ. of New South Wales, Australia). IEEE Trans. Plasma Sci.; PS-3: No. 2, 90-94(Jun 1975).

The one dimensional nonlinear hydrodynamic equations describing longitudinal cold plasma oscillations are studied by the classical Lagrangian-Euler method. A new method to invert the solutions from Lagrangian to Euler description is introduced. It is also shown in this paper that this method is capable of yielding results identical to those from KBM perturbation to second order of approximation. The new method, however, produces higher order approximations much more rapidly. (auth)

19530 STRONG WAVE PROPAGATION IN A MAGNETIZED PLASMA. Stewart, P. (Manchester Univ. (UK). Dept. of Mathematics). Astron. Astrophys.; 34: No. 3, 463-464(Sep 1974). 6 refs.

A dispersion relation is calculated for a strong circularly polarized wave which propagates parallel to a uniform magnetic field for a hot relativistic electron gas. The relation is discussed in connection with wave propagation through the Crab nebula. (orig.)

ENGINEERING

Energy Conversion

19531 (GEPP-173) THEORETICAL ANALYSIS OF HEAT TRANSFER IN, AND ELECTRICAL PERFORMANCE OF, A MILLIWATT RADIOISOTOPIC POWERED THERMOELECTRIC GENERATOR. Biver, C. J. (General Electric Co., St. Petersburg, Fla. (USA). Neutron Devices Dept.). 22 Jul 1975. Contract E(29-2)-656. 83p. Dep. NTIS $7.25.

A simplified, theoretical model has been made for a radioisotope-powered milliwatt thermoelectric generator (RTG). Calculations of unit heat transfer and electrical performance characteristics are made in two ways: (a) using discrete values of input physical parameters for an individual unit; and (b) using a statistical simulation (Monte Carlo) approach for estimating the variation in performance in a group of N-units. The statistical simulation approach is useful in: (a) estimating the allowable range of input parameters conducive to the production design meeting specifications in a group of N-units; and (b) determining particular parameters that must be significantly restricted in variation to achieve desired performance. The available experimental data, as compared with the discrete value calculations, are in quite good agreement (within 5 percent generally). (auth)

Facilities and Equipment

19532 (ORNL-5044(Vol.2)) STRESS ANALYSES OF FLAT PLATES WITH ATTACHED NOZZLES. Vol. 2: Experimental Stress Analyses of a Flat Plate With One Nozzle Attached. Battiste, R. L.; Peters, W. H.; Ranson, W. F.; Swinson, W. F. (Oak Ridge National Lab., Tenn. (USA)). Jul 1975. Contract W-7405-eng-26. 124p. Dep. NTIS $5.45.

Vol. 1 of this report compares experimental results with theoretical stress distributions for a flat plate with one nozzle configuration and for a flat plate with two closely spaced nozzles attached. This volume contains the complete test results for a flat plate with one nozzle attached that was subjected to 1:1 and 1:2 biaxial planar loadings on the plate, to a thrust loading on the nozzle, and to a moment loading on the nozzle. The plate tested was 36 × 36 × 0.375 in., and the attached nozzle had an outer dia of 2.625 in. and a 0.250-in.-thick wall. The nozzle was located in the center of the plate and was considered to be free of weld distortions and irregularities in the junction area. (auth)

19533 (UCRL-76740) AUTOMATED SAMPLE CHANGER FOR X-RAY FLUORESCENCE ANALYSIS OF BIO-MEDICAL SAMPLES. Camp, D. C.; Voegele, A. L.; Friesen, R. D.; Kaufman, L.; Hruska, B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 22 Jul 1975. 15p. Dep. NTIS $4.00.

The basic components and operation of the changer are described. The more important mechanical features are presented. A brief description is given of the basic electronic logic used for control. (TFD)

19534 (Y-1972) ANALYSIS OF STRESSES IN FILAMENT-WOUND SPHERICAL PRESSURE VESSELS PRODUCED BY THE DELTA-AXISYMMETRIC PATTERN. Knight, C. E. Jr. (Oak Ridge Y-12 Plant, Tenn. (USA)). 8 Aug 1975. Contract W-7405-eng-26. 82p. Dep. NTIS $4.00.

Spherical pressure vessels may be produced by filament winding the composite material with a delta-axisymmetric pattern. This particular pattern yields a composite with high fiber density and efficient and reproducible structures. The pattern is readily defined mathematically and, thus, eases the analysis problem. (auth)

19535 EQUIPMENT FOR THE SEPARATION OF TWO PHASES OF THE FLUID–FLUID EXTRACTION IN A CENTRIFUGE. Havezov, I.; Stoeppler, M. (to Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany)). German(FRG) Patent 2,115,032/B/. 26 Sep 1974. 2p. (In German).

1 fig.

The invention refers to a device for the separation of two phases in a centrifuge in connection with liquid–liquid extraction. The centrifugation vessel which is open at one end and sealable by a stopper is inserted into the centrifuge rotor with the closed end outwards. A channel that reaches from the open end as far as the near of the closed one, serves to draw out the heavy phase. The device is useful for the discontinuous determination of distribution factors, particularly those of radioactive materials. (GE)

19536 COMPUTER SYSTEM FOR 50 MW STEAM GENERATOR TEST FACILITY (SGF-50), POWER REACTOR AND NUCLEAR FUEL DEVELOPMENT CORPORATION. Uede, T.; Kinoshita, M.; Shimaoka, S. (Fuji Electric Co. Ltd., Tokyo (Japan)). Fuji Jiho; 47: No. 6, 496-502(Jun 1974). (In Japanese).

Prior to the delivery of the 50 MW Steam Generator Test Facility (SGF-50) to Power Reactor and Nuclear Fuel Development Corporation, it is now undergoing test operation. Constructed for the development of a sodium-cooled fast breeder reactor, the SGF-50 has as its purpose the development of a steam generator and the operational experiences with a large-scale Na loop equipped with a steam generator. The computer system attached to the SGF-50 is used for the program control, data processing and data recording of facility operation. By its use, high efficiency of tests, prevention of errors in design values, rapid analysis of data, reduction of operators, etc. are expected. After outlining the SGF-50 plant, constitution of the computer system and its functions are described. (JA)

19537 FLOW OF LIQUID METALS WITH A TRANSVERSELY APPLIED MAGNETIC FIELD. III. Influence of Electric and Magnetic Field on Flow Transition. Sudou, K.; Tomita, Y. (Tokyo Inst. of Tech. (Japan)). Nippon Kikai Gakkaishi; 40: No. 332, 983-992(Apr 1974). (In Japanese).

The application of electromagnetic hydrodynamics to metal-working industry and to foundry is considered. The main object is electromagnetic pumps. The precise investigation of the flow conditions in the electromagnetic pumps is very important to acquire the necessary data for developing the electromagnetic pumps and also to evaluate the performance of the pumps. This paper reports on the experimental studies of the effect of electromagnetic field on the flow transition in conductive type electromagnetic pumps. In this experiment, liquid mercury flows through a tube with rectangular section of 12.3:1 side ratio, and short magnetic field is transversely applied to the liquid mercury flow. Through electrodes attached to side wall, electric current is conducted to the liquid mercury. The measurement of the flow was performed by changing magnetic flux density and the magnitude and direction of current. As a result, it was found that as the magnitude of electric current became larger, transition Reynolds number decreased further. (JA)

19538 FLOW OF LIQUID METALS WITH A TRANSVERSELY APPLIED MAGNETIC FIELD. IV. Resistance Coefficient for Turbulent Flow. Sudou, K.; Tomita, Y. (Tokyo Inst. of Tech. (Japan)). Nippon Kikai Gakkaishi; 40: No. 332, 993-1002(Apr 1974). (In Japanese).

There are few reports on the turbulent flow of conductive fluid in a flow channel transversely applied with magnetic field, although the study on the turbulent flow of conductive fluid is very important to offer the basic design data for an electromagnetic pump or an electromagnetic flow meter. This paper reports on the theoretical analysis of the turbulent flow of conductive fluid between insulated plates with transversely applied magnetic field, introducing Hartmann effect and the effect of restraining turbulent flow by electromagnetic force into Prandtl's theory of mixing length. This analytical method involves many hypotheses and lacks exactness especially. However, the results of the frictional coefficient of a rectangular tube agree relatively well with experimental results over the wide range of Reynolds number and the range of small Hartmann's number. The degree of agreement between the theoretical results and the experimental ones becomes worse, as the Hartmann's number increases. This analytical method and result can be technologically applied to the design of electromagnetic pumps. (JA)

19539 FLOW OF LIQUID METALS WITH A TRANSVERSELY APPLIED MAGNETIC FIELD. V. Analysis of Turbulent Flows in a Circular Pipe. Sudou, K.; Tomita, Y. (Tokyo Inst. of Tech. (Japan)). Nippon Kikai Gakkaishi; 40: No. 332, 1003-1012(Apr 1974). (In Japanese).

It is very important to clarify the effect of magnetic field on the turbulent flow of liquid metals, for acquiring the basic data necessary to develop and design a liquid metal magnetohydrodynamic generator, an electromagnetic pump or an electromagnetic flow meter. This paper reports on the theoretical analysis of the turbulent flow of liquid metal in a circular pipe with transversely applied uniform magnetic field, by introducing the concept of Prandtl's mixing length into momentum transportation theory. The region in which uniform magnetic field acts is very large in flow direction, so that the flow in a pipe can be regarded as completely developed turbulent flow. Tube wall is electrically in-

sulated. This analytical method has many hypotheses and cannot effectively clarify the mechanism of flow. The result of frictional stress coefficient of flow satisfactorily agrees with experimental result over the wide range of Reynolds number. However, the degree of agreement between the theory and the experiment becomes worse, as Hartmann's number becomes larger. This is because viscous stress is neglected. (JA)

19540 RESIDUAL STRESS MEASUREMENT OF MULTI-LAYERED PLATE BY X-RAY METHOD. Doi, O.; Ukai, T. (Hokkaido Univ., Sapporo (Japan). Faculty of Engineering). Nippon Kikai Gakkai Rombunshu; 40: No. 337, 2513-2525(Sep 1974). (In Japanese).

The theory of residual stress measurement for multi-layered plates by characteristic x-ray diffraction is presented. Though this method has not necessarily sufficient accuracy at present because it depends largely upon the structure and the composition of objective metal, fairly good accuracy can be expected for stress above a certain degree. There are two methods of front and rear irradiation. The equations for exact stress calculation are given to each method. The equations for single layer plates derived as the special case of the multi-layered plates to agreed with the one which had been already obtained. When the temperature at the time of measurement is different from the reference temperature, temperature compensation is the function of temperature difference and removed thickness. In the equations for front irradiation method, calculation error is less as compared with rear irradiation method because the former does not include the differentiation term of measured stress value. Examples of the results for a two-layer electro-deposited plate and a commercially available bimetal by front irradiation are reported. The former was confirmed for its practicality by being compared with strain gauge method. (auth)

19541 CALIBRATION OF CASCADE IMPACTOR BY TWO-STAGE METHOD. Ohata, T.; Matsui, H.; Murata, M.; Naritomi, M.; Ikezawa, Y. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). J. Nucl. Sci. Technol. (Tokyo); 11: No. 11, 510-515(Nov 1974).

A simple method of calibrating the cascade impactor has been developed by applying Hongo et al.'s two-stage method to evaluate the particle-size distribution. The constants $\bar{\psi}$ and $\bar{\sigma}$ for a function representing the impaction efficiency were determined for the UNICO cascade impactor, using the test particles produced by a spinning-disc aerosol generator. The values were $\bar{\psi} = 0.35$, $\bar{\sigma} = 1.46$, respectively. The validity of the method for the UNICO cascade impactor was confirmed from microphotographic observation of a sample artificial aerosol containing different sizes of uranine methylene-blue particles. Both the mass median aerodynamic diameter and the geometric standard deviation obtained with the method agreed with the microphotographic measurements with relative errors not exceeding 10%. (auth)

19542 AUTOMATION OF X-RAY STRESS MEASUREMENT BY SMALL DIGITAL COMPUTER. Hayama, T.; Hashimoto, S. (Hitachi Ltd., Tokyo (Japan)). pp 279-285 of Mechanical Behavior of Materials. Proceedings of the 1973 Symposium. Kyoto, Japan; Society of Materials Science (1974).

From 1973 symposium on mechanical behavior of materials; Kyoto, Japan (21 Aug 1973).

Although the reliability of x-ray stress measurement has been remarkably improved, the accuracy of the measurement for hardened materials is not sufficient because of the broadness of the profile of the diffraction line. For the improvement of the accuracy and for the automation of x-ray stress measurement, a fully automatic x-ray stress measuring system using a small digital computer was developed. The step scanning mechanism was introduced for the scanning of the counter, in order to increase the sampling time without increasing the total time for measurements. A small digital computer HITAC 10 having a memory of 12K (16 bits) was used for data processing and automation. According to the results of the experiments using the new system, the accuracy of the measurement is expected to be approximately ±1 kg/mm^2 for hardened materials. Moreover the time for measurement was reduced 40 to 60 min. that is $\frac{1}{3}$ to $\frac{1}{2}$ of the time necessary for an ordinary apparatus. The reason for the improvement in accuracy is explained by an analysis based on statistical fluctuation. (auth)

19543 X-RAY MEASUREMENT OF RESIDUAL STRESS INDUCED IN CARBON STEELS BY PLASTIC DEFORMATION. Taira, S.; Hayashi, K. (Kyoto Univ. (Japan). Faculty of Engineering); Ozawa, S. pp 287-295 of Mechanical Behavior of Materials. Proceedings of the 1973 Symposium. Kyoto, Japan; Society of Materials Science (1974).

From 1973 symposium on mechanical behavior of materials; Kyoto, Japan (21 Aug 1973).

A method is proposed for obtaining only the macroscopic component of the residual stress induced in a plain carbon steel by axisymmetric plastic deformation such as tension and drawing. This component is calculated from the stress values measured with respect to {211} and {310} planes and also from the carbon content. The effect of elastic anisotropy and the combined effect of elastic anisotropy and texture are also taken into consideration. The method newly proposed is applied to the measurement of residual stresses induced in two kinds of carbon steels by cold drawing. The results obtained by this X-ray method are compared with those obtained by the Sachs method, and a good agreement is observed between them. (auth)

Lasers

Refer also to abstract 19305.

19544 (CONF-7310113-(absts)) TWENTY-SIXTH ANNUAL GASEOUS ELECTRONICS CONFERENCE. Program and Abstracts. (Wisconsin Univ., Madison (USA)). 1973. 127p. University of Wisconsin, Madison.

From 26th annual gaseous electronics conference; Madison, Wisconsin, USA (16 Oct 1973).

Abstracts of the approximately 158 papers given at the conference are presented. The abstracts are arranged under sessions entitled: Transport and Glow Discharges; CO and Argon Ion Lasers; Negative Ions; Laser Ionization Processes; Recombination and Excitation; Distribution Functions; Excitation Transfer; HF and other Lasers; Ion-Molecule Collisions; CO_2 Kinetics and Excitation Transfer; Vacuum Ultraviolet Lasers I; Electron-Molecule and Charge Transfer Collisions; Vacuum Ultraviolet Laser II; Electron-Atom Collisions; Energy Transfer; Avalanches and Streamers; Flow and Magnetic Effects; Steady and Non-Steady Arcs; Non-Equilibrium in Arcs; Photon Interaction and Breakdown; Physics of Arc Light Sources; Radiation; Thermal and Radiation Properties of Arcs; and Electrode Effects in Arcs. (TFD)

19545 (LA-UR-75-839) LASER APPLICATION OF HEAT PIPE TECHNOLOGY IN ENERGY RELATED PROGRAMS. Carbone, R. J. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-ENG-36. 16p. (CONF-750812-11). Dep. NTIS $4.00.

From 10th intersociety energy conversion engineering conference; Newark, Delaware, USA (17 Aug 1975).

The design and operating parameters for a heat pipe laser utilizing metal vapors are proposed. The laser would be applied to laser induced fusion, laser induced chemistry, laser isotope separation, and power transport using optical beams. (TFD)

19546 (UCRL-75490) REVIEW OF BOUND FREE LASER SYSTEMS. Rhodes, C. K. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 14 Feb 1974. 6p. (CONF-740404-3). Dep. NTIS $4.00.

From Region 6 conference; Albuquerque, New Mexico, USA (24 Apr 1974).

The properties of the stimulated emission arising from high pressure rare gases excited by relativistic electron beams are summarized. The three materials reported to date are argon, krypton, and xenon which produce intense stimulated spectra at ~1265 Å, ~1475 Å, and ~1720 Å respectively. (auth)

19547 PROBE MEASUREMENTS OF PLASMA PARAMETERS IN ION METAL VAPOR LASERS. Kopiczynski, T.; Mizeraczyk, J.; Zakrzewski, Z. (Inst. of Fluid Flow Machines, Gdansk, Poland). Bull. Acad. Pol. Sci., Ser. Sci. Tech.; 22: No. 12, 1065-1071(1974).

The specific features resulting from the presence of the electron-neutral and ion-neutral collisions in ion metal-vapor lasers are discussed in detail. The resulting criteria for the probe dimensions are presented. A method of interpretation of results is described which allows to calculate the electron density without the laborious iteration procedure. (auth)

19548 INFLUENCE OF PARABOLICAL RADIAL GAIN DISTRIBUTION OF A MEDIUM WITH GRAIN SATURATION ON LASER MODES. I. Mizeraczyk, J.; Chojnacki, J. (Inst. of Fluid Flow Machines, Gdansk, Poland). Bull. Acad. Pol. Sci., Ser. Sci. Tech.; 22: No. 12, 1073-1078(1974).

Approximate theory of a laser resonator filled with a nonlinear active medium is presented under the assumption that the gain distribution over the transverse cross-section of the resonator is parabolic. Calculations for media having uniform transverse gain is included. The results suggest that the mode patterns are identical in both cases. It means that the influence of a parabolic radial gain distribution on the field distribution

in the active confocal resonator is negligible within the gain range examined. (auth)

19549 INFLUENCE OF PARABOLICAL RADIAL GAIN DISTRIBUTION OF A MEDIUM WITH GRAIN SATURATION ON LASER MODES. II. Mizeraczyk, J.; Chojnacki, J. (Inst. of Fluid Flow Machines, Gdansk, Poland). Bull. Acad. Pol. Sci., Ser. Sci. Tech.; 22: No. 12, 1079-1085(1974).

The paper comprises the results of the numerical calculations of the field distributions over the mirrors of a confocal resonator, filled with such an active medium, made on the basis of an integral equation being derived in Part I of this paper. The paper includes also the final remarks which refer to both parts of this work. (auth)

19550 CLOSED CYCLE GAS DYNAMIC LASER. Pinsley, E. A. (to United Aircraft Corp.). US Patent 3,886,475. 27 May 1975. Filed date 26 Feb 1973. 4p.

The device includes a closed cycle gas dynamic laser wherein the lasing fluid is recirculated in a closed loop. The closed loop includes a nozzle array, a lasing cavity and a diffuser. The exit of the diffuser is connected to the inlet to the nozzle array with a fuel heat exchanger located in the lasing flow and a pumping means located between the heat exchanger and the nozzle array. To provide for cooling of the pumping means and to improve diffuser performance, gas bled from the diffuser is cooled by two heat exchangers and pumped into cooling passages in the pumping means. The heat exchangers for cooling the flow to the pumping means are located in series and carry fuel from a supply to an injector in said combustor and the heat exchanger in the lasing flow cools the fluid and carries the fuel from a supply to an injector in said combustor. (auth)

19551 MULTI-STAGE SYSTEM. Witt, D. L.; Staley, C. F. (to United Aircraft Corp.). US Patent 3,886,476. 27 May 1975. Filed date 24 May 1968. 4p.

A high power gas dynamics laser device having multiple expansion-diffusion stages for gas flow and multiple reflection optic having a plurality of passes for the generation of laser power is described. The gaseous working fluid is provided by a combustion system. The combustion products are expanded through nozzles to obtain a population inversion and then a diffuser is used to recover the dynamic pressure. The gas flow follows four stages, the first three stages are single expander-diffuser units in series and the fourth stage is a larger sized stage having flow in two parallel expander-diffuser units. The nozzles of the first three stages are sized and contoured to obtain pressure in their laser cavities which are as equal as possible and the nozzle exit Mach. no. is made approximately equal. (auth)

19552 GAS LASER HAVING AN INTEGRAL OPTICAL RESONATOR WITH EXTERNAL STABILIZING MEANS. Hensolt, R. A.; Dowley, M. W. (to Coherent Radiation). US Patent 3,886,474. 27 May 1975. Filed date 30 Apr 1973. 4p.

A gaseous laser having an internal optical resonator is provided with external stabilizing means for maintaining alignment of mirrors forming the optical resonator. Means are provided for allowing expansion of the remainder of the gas-confining envelope relative to the stabilized resonator mirrors during the operation of the laser. (auth)

19553 LASER SYSTEM FOR PRODUCING VARIABLE DURATION SHORT PULSES. Milam, D.; Schlossberg, H.; Szoke, A. (to Secretary of the United States Air Force). US Patent 3,879,686. 22 Apr 1975. Filed date 20 Sep 1973. 6p.

A laser system for producing intense variable duration short pulses in the range of 0.1 to 3.0 nanoseconds is described. The laser system utilizes a Michelson interferometer set for maximum reflection at the lasing frequency as one end element. A phase or amplitude switch is placed in the cavity in front of the interferometer in order to change the input to the interferometer resulting in a pulse out of the interferometer whose duration is given by twice the difference in path length of the interferometer arms divided by the speed of light. (auth)

19554 X-RAY LASERS. Kepros, J. G.; Eyring, E.; Cagle, F. W. (to University of Utah). US Patent 3,882,312. 6 May 1975. Filed date 22 Jun 1973. 4p.

A method of producing collimated x-radiation by suitably subjecting metallic ions to a pulse of laser energy from a conventional laser is described. (auth)

19555 MEASUREMENT OF THE 1.15-μm WAVELENGTH OF A HELIUM–NEON LASER. Solomakha, D. A.; Toropov, A. K. Opt. Spectrosc.; 38: No. 1, 92-93(Jan 1975).

Translated from Opt. Spectrosk.; 38: No. 1, 167-169(Jan 1975).

Absolute measurements of the wavelength of a laser in the ir range with an accuracy of the order of 10^{-7} and higher are necessary when using a laser in spectroscopy as a source of standard wavelengths, for the indirect determination of the velocity of light in vacuum, when constructing an absolute standard of time, frequency, and length, etc. The wavelength of the 1.15 μm He–Ne laser, stabilized on the Lamb dip, was determined using two piezoelectrically tuned Fabry–Perot interferometers with mirror separations (at 20°C) of 198.737 mm and 94.976 mm. The wavelength was found to be 1.15259016 ± 0.00000006. (TFD)

19556 LASER SYSTEMS WITH DIAMOND OPTICAL ELEMENTS. Seitz, J. R. (to Entropy Conversion, Inc.). US Patent 3,895,313. 15 Jul 1975. Filed date 17 Sep 1973. 16p.

High power laser systems with optical elements of diamond having a thermal conductivity of at least 10 W/cm.°K at 300°K and an optical absorption at the laser beam wavelength of no more than 10 to 20% are described. (auth)

19557 METHOD AND APPARATUS FOR OBTAINING VERY HIGH ENERGY LASER PULSES: PHOTON CYCLOTRON. Vali, V.; Krogstad, R. S.; Goldstein, R. US Patent 3,886,480. 27 May 1975. Filed date 12 Apr 1973. 12p.

Apparatus is arranged in selected embodiments of several combinations, each sometimes being referred to as a system, and each embodiment establishing a large enclosable chamber containing a laser energy reacting medium through which a laser beam is created. When laser energy pulses of such a beam are created, they are guided in a continuous path using reflectors in this chamber, and they receive supplemental energy units from multiple spaced laser pumps. Each laser pump is effective in respect to its own inverted population laser energy source, and each laser pump is triggered by an overall excitation control system. The laser beam is thereby supplemented to a higher level at each laser pump. Yet at all times the laser energy reacting medium remains at a level below super radiance. A working unit or working pulse of a laser beam is allowed to escape from each large enclosable chamber through an escape exit only when a preselected very high energy level is reached. The escape exit of this chamber may be designed to be destroyed by the exiting high level pulse energy of the laser beam. Also an escape exit may be opened upon the operation of a piezoelectric decoupler. (auth)

19558 POWER STABILIZED CO_2 GAS TRANSPORT LASER. Foster, J. D.; Kirk, R. F.; Moreno, F. E.; Ahmed, S. A. (to GTE Sylvania Inc.). US Patent 3,886,481. 27 May 1975. Filed date 11 Jun 1973. 4p.

The output power of a high power (1 kW or more) CO_2 gas transport laser is stabilized by flowing the gas mixture over copper plated baffles in the gas channel during operation of the laser. Several other metals may be used instead of copper, for example, nickel, manganese, palladium, platinum, silver and gold. The presence of copper in the laser gas circuit stabilizes output power by what is believed to be a compensation of the chemical changes in the gas due to the cracking action of the electrical discharge which has the effect of diminishing the capactiy of the carbon dioxide gas mixture to maintain the rated power output of the laser. (auth)

19559 TRAVELING WAVE LASER SYSTEM. Gregg, D. W.; Kidder, R. E.; Biehl, A. T. (to Energy Research and Development Administration). US Patent 3,886,482. 27 May 1975. Filed date 19 Sep 1973. 14p.

The invention broadly involves a method and means for generating a traveling wave laser pulse and is basically analogous to a single pass light amplifier system. However, the invention provides a traveling wave laser pulse of almost unlimited energy content, wherein a gain medium is pumped in a traveling wave mode, the traveling wave moving at essentially the velocity of light to generate an amplifying region or zone which moves through the medium at the velocity of light in the presence of directed stimulating radiation, thereby generating a traveling coherent, directed radiation pulse moving with the amplification zone through the gain medium. (auth)

19560 CLOSED CYCLE DEVICE. Ruby, L. E.; Witt, D. L.; Staley, C. F. (to United Aircraft Corp.). US Patent 3,886,477. 27 May 1975. Filed date 29 Oct 1968. 6p.

A gas dynamic laser wherein the lasing fluid is recirculated in a closed loop is described. The flow can be assumed to start with the lasing gas passing through a cascade of supersonic nozzles. This low pressure, high velocity gas is then passed through a lasing cavity where the lasing action takes place. The energy of the high velocity gas stream is converted back to static pressure in a supersonic diffuser. The diffuser is constructed with (1) variable geometry, and (2) provisions for bleeding off the boundary layer for improved efficiency. Downstream of the supersonic diffuser there is a heat exchanger which partially cools the gas in the loop. This partially cooled gas is then supplied to a compressor where the pressure and temperature are raised back to the level at the start

of the flow. The lasing gas is directed from the exit of the compressor to a manifold upstream of the cascade of supersonic nozzles. The compressor only supplies a pressure rise equal to the pressure loss by inefficiencies in the nozzle, the supersonic diffuser and the pressure drop in the heat exchanger and plumbing. To provide for cooling of the compressor, the gas bled from the diffuser is cooled by a second heat exchanger and pumped back to compressor inlet pressure and introduced into the compressor for cooling. In steady state operation, both heat exchangers referred to above, are designed to regulate the nozzle inlet gas temperature by removing the amount of heat energy added by compressing minus the amount of energy extracted in the lasing beam and energy lost to the environment. The compressor and pumping means for cooling the compressor can be driven by any means desired. (auth)

19561 MULTI-COMPONENT FLOW INJECTOR PUMP FOR A FLOWING GAS LASER WITH LOW OUTPUT PRESSURE. Milling, R. W. (to Secretary of the Air Force). US Patent 3,886,478. 27 May 1975. Filed date 5 Nov 1973. 4p.

A pumping system for a chemical laser having a heat exchanger in the output for supplying heat to the diluent carrier gas from a high pressure gas supply is described. The diluent carrier gas is used to accelerate solid particles which are then separated from the gas stream and used to accelerate the output gas of the laser. The kinetic energy of the gas stream is then converted to a gas stream pressure in an expanding channel. The solid particles are then removed from the gas and returned to the particle supply. (auth)

19562 ELECTRODE SYSTEMS FOR GAS DISCHARGE DEVICES PARTICULARLY GAS LASERS. Pearson, P. R. (to National Research and Development Corp.). US Patent 3,886,479. 27 May 1975. Priority date 4 Dec 1970, United Kingdom of Great Britain and Northern Ireland. 10p.

An electrode system is described in which a uniform discharge between a pair of main electrodes is initiated by one or a plurality of auxiliary discharges originating from one or more auxiliary electrodes outside the line of centers of the main electrodes. The auxiliary electrodes are arranged to provide a field concentration in their vicinity. Particularly suitable for use as auxiliary electrodes are wires, rows of pins, and sharp metallic edges. (auth)

19563 PLASMA PUMPED LASER. Miley, G. H. (to Energy Research and Development Administration). US Patent 3,886,483. 27 May 1975. Filed date 31 Oct 1973. 8p.

The invention relates to a laser and in particular to a laser utilizing a plasma to create a population inversion in the laser active medium. The laser can be pumped by the output plasma from a fusion reactor, for example, or by plasma from other sources. Either the plasma ions or electrons or both can be used to pump the laser. Also the plasma ions can be used to provide energy to achieve a chemical laser action. (auth)

19564 GAS LASER TUBE AND METHOD OF FABRICATING SAME. Garman, L. E. US Patent 3,887,883. 3 Jun 1975. Filed date 29 Oct 1973. 8p.

An improved gas laser tube is fabricated by counter boring the ends of a tubular aluminum extrusion having an inner tubular portion supported from an outer tubular portion via the intermediary of a plurality of radially directed support vanes or legs. Metallic transverse walls are sealed across the ends of the tubular extrusion to define the ends of a gas tight metallic envelope. An electrically insulative glow discharge tube is axially disposed within and supported by the inner tubular portion of the extrusion in axial alignment with an optical resonator of the laser tube. (auth)

19565 EXTENDED AREA CATHODE FOR TRANSVERSE DISCHARGE GAS LASERS. Parker, J. V. (to Hughes Aircraft Co.). US Patent 3,876,958. 8 Apr 1975. Filed date 14 Dec 1975. 8p.

Laser cathodes of extended emission area are disclosed having a plurality of substantially aligned electrically conductive plates spaced from one another and disposed in respective planes perpendicular to the longitudinal axis of the laser housing. Adjacent plates are spaced by a spacing s selected to achieve the "hollow" cathode effect and satisfying the relation s equals k/p where p is the laser gas pressure and k is a constant determined by the laser gas and lying in the range of from about 5 to about 20 torr-cm. In one embodiment the cathode plates are supported by and attached to a pair of longitudinally extending electrically conductive rods. In another embodiment the cathode consists of a laminated array of alternatively disposed aligned taller and shorter electrically conductive plates. (auth)

19566 REGENERATIVE LASER SYSTEM. Biancardi, F. R.; Landerman, A.; Melikian, G. (to United Aircraft Corp.). US Patent 3,876,959. 8 Apr 1975. Filed date 11 Jul 1974. 8p.

Regenerative apparatus for exhausting the working medium from the optical cavity of a laser and for supplying preheated diluent to the reaction chamber of a laser is disclosed. In an aftercooler thermal energy is exchanged between the working medium exhausted from the optical cavity and a cryogenic coolant which is subsequently utilized as the motive fluid for an ejector and as a diluent in the production of laser gas. Highly toxic and corrosive gases are condensed out of the working medium as the cryogenic coolant is evaporated and superheated. A preheater transfers additional heat to the diluent before the diluent enters the reaction chamber. (auth)

19567 GAS-ION LASER WITH GAS PRESSURE MAINTENANCE MEANS. Thatcher, J. B. (to Holosonics, Inc.). US Patent 3,876,957. 8 Apr 1975. Filed date 15 Oct 1973. 8p.

A gas-ion laser is described including means to maintain the ionizable gas in the laser cavity at a rather constant pressure over an extended period of time to significantly increase the useful life of the gas-ion laser. The gas laser includes a gas makeup system having a high pressure source or storage container and a regulating valve. The valve has a permeable solid state orifice member through which the gas flows from the high pressure source to the laser cavity to replenish the gas in the laser cavity and maintain the gas pressure in the cavity rather constant. The permeable orifice member is selected from a solid state material having a permeability that is variable in relation to the magnitude of the energy applied to the orifice member. The gas-ion laser has a valve operating means such as a heater for varying the applied energy such as thermal energy to the member to regulate the gas flow. Additionally, the gas-ion laser has a valve control means that is responsive to the gas pressure in the laser cavity for controlling the valve control means to maintain the pressure at a desired level. (auth)

19568 POSSIBILITIES OF DESIGNING LASER LIGHT MODULATORS FOR PHOTOGRAPHIC SOUND RECORDING. Burgov, V. A.; Remizov, V. V. Tekh. Kino Telev.; No. 6, 37-42 (Jun 1974). (In Russian).

Two ways of designing light modulators are considered for variable-area photographic sound recording with the application of an industrial argon laser working in continuous mode and a special electron-ray tube with a semiconductor screen. A diagram for obtaining two-side variable area sound record with noise decrease is suggested. (Elect. Electron. Abstr.)

19569 EXCITATION AND EMISSION IN N_2 PULSED GAS LASERS. Guendel, H.; Ross, W. (Zentralinstitut fuer Elektronenphysik, Berlin). Ann. Phys. (Leipzig); 31: No. 3, 263-276 (Sep 1974). (In German).

A theoretical treatment of pulsed nitrogen laser operation is presented. The properties of laser pulses were investigated as functions of various parameters (electric circuit parameters, laser length, gas pressure). Based on this model some conditions are obtained which are necessary for effective laser pulse emission, and the known nitrogen laser devices are discussed. (auth)

19570 EXPERIMENTAL INVESTIGATION OF EXCITATION AND EMISSION IN THE PULSED NITROGEN LASER. Ross, W.; Guendel, H. (Zentralinstitut fuer Elektronenphysik, Berlin). Exp. Tech. Phys.; 22: No. 6, 541-548(1974). (In German).

The influence of electric current density and other parameters on the laser pulse energy have been investigated. The experimental results agree with a recently published model of laser pulse emission in the nitrogen laser. (auth)

19571 GENERATION OF TUNABLE, COHERENT UV-RADIATION BY USE OF DYE LASERS. Scholz, M.; Koenig, R.; Leupold, D. (Zentralinstitut fuer Optik und Spektroskopie, Berlin). Exp. Tech. Phys.; 22: No. 6, 557-563(1974). (In German).

The possibilities of generation of tunable, coherent uv-radiation are discussed. The fitness of SHG and SFG for uv-generation in the spectral region from 230 nm to 400 nm is demonstrated by transformation of dye-laser radiation in ADP. (auth)

19572 LASER POWER SUPPLY. Whitehouse, D. R.; Hartshorn, D. W. (to Raytheon Co.). US Patent 3,896,396. 22 Jul 1975. Filed date 14 May 1973. 8p.

A method of energizing a laser source stimulating flash lamp directly from an ac power line is presented. Uncontrolled diodes couple the anode and cathode of the flash lamp directly to the ac line. The lamp is triggered by a separate triggering circuit which produces its trigger pulse at a predetermined phase of the ac power source. The use of high current carrying controlled rectifiers and large energy storage devices is thereby eliminated. (auth)

19573 TUNABLE INFRARED/ULTRAVIOLET LASER. Hodgson, R. T.; Lankard, J. R.; Sorokin, P. P.; Wynne, J. J.

(to International Business Machines Corp.). US Patent 3,892,979. 1 Jul 1975. Filed date 5 Apr 1974. 6p.

An infrared source producing a coherent output having a spectrally narrow and continuously tunable frequency is described. Such a source uses a four wave mixing process in an alkali metal vapor, wherein the initial input beams to the alkali metal vapor come from two dye lasers. In an alternative mode of operation, tunable ultraviolet output is obtained. (auth)

19574 DRIVER CIRCUIT FOR PULSE MODULATION OF A SEMICONDUCTOR LASER. Ueki, A. (to Nippon Electric Co.). US Patent 3,896,398. 22 Jul 1975. Priority date 10 Nov 1972, Japan. 6p.

A pulse modulation driver circuit for a semiconductor laser is disclosed which discriminates among input pulse signals composed of binary codes to detect the occurrence of a pulse having a code of "1" following a pulse having a code of "0". Detection of this pattern is used to control the driver to increase either or both the width or peak value of the pulse having a code of 1. The effect of this is to eliminate a pattern effect in the light emitted by the semiconductor laser caused by an attenuation of the population inversion in the laser. (auth)

19575 NUCLEAR LASER STORY. Schneider, R. T. (Univ. of Florida, Gainesville). New Sci. (London).; 67: No. 956, 13-16(3 Jul 1975).

The nuclear-pumped laser, demonstrated recently by two independent teams, using the atomic states generates light or infrared radiation by the usual lasing process. The program of recent research towards nuclear pumping is outlined and the problems of exciting a laser gas with electrons and of obtaining a fission fragment flux available for experimentation so that different potential laser-gas mixtures could be tested are outlined. The difficulties encountered in this field of research are discussed. (UK)

19576 MAGNETIC SEPARATION. The Prospects for Superconductivity. Maxwell, E. (Massachusetts Inst. of Tech., Cambridge). Cryogenics; 15: No. 4, 179-184(Apr 1975).

Conventional methods of magnet separation are described and the processes which could benefit from the use of superconductors are discussed. These include the use of superconductors in high gradient magnetic separators which is one such area finding commercial applications, and a possible large-scale future application for water purification and waste-water treatment. (auth)

19577 THEORY OF PARAMETRIC FOUR-PHOTON INTERACTION. III. Amplification and Oscillation with Consideration of the Depletion of the Pump Wave. Frahm, J.; Fischer, R. (Zentralinstitut fuer Optik und Spektroskopie, Berlin). Ann. Phys. (Leipzig); 31: No. 2, 143-170(Jun 1974). (In German).

The processes of parametric amplification and oscillation in a medium with cubic polarization are investigated theoretically taking into consideration the depletion of the pump wave. It is assumed that phase-matching is realized exactly (a possible nonlinear detuning of the exact phase-matching should be compensated by a suitable subsequent adjustment of the frequencies). A consequence of linear losses is the appearance of a threshold for the parametric amplification. There exist a maximum length, a minimum length and an optimum length of the nonlinear medium for the process of parametric amplification. The threshold intensity, the optimum length of the nonlinear medium and the optimum reflection coefficient for outcoupling are determined for two arrangements of the double resonant parametric four-photon oscillator (ring resonator, Fabry-Perot resonator). It is shown that for the above mentioned arrangements of the single resonant and the double resonant four-photon oscillator the efficiency is a monotonous function of the threshold excess. On the contrary in case of the three-photon oscillator there exists an optimum value of the threshold excess. (auth)

Cryogenic and Superconducting Equipment and Devices

Refer also to abstracts 19615, 20459, 20463, and 20464.

19578 (BNL-19839) DIELECTRIC DESIGN CONSIDERATIONS FOR A FLEXIBLE SUPERCONDUCTING POWER TRANSMISSION CABLE. Forsyth, E. B.; McNerney, A. J.; Muller, A. C. (Brookhaven National Lab., Upton, N. Y. (USA)). 1975. 11p. (CONF-750716-4). Dep. NTIS $4.00.

From international cryogenic materials conference; Kingston, Ontario, Canada (22 Jul 1975).

Examination of the dielectric and mechanical properties of the five tapes evaluated indicates that none simultaneously fulfills all the requirements of superconducting cable design, however, several have excellent properties and are close to meeting these requirements. Polyethylene easily meets the dielectric requirements but was found to possess substandard yield strengths and tensile moduli. Polyamide and polysulfone exhibited acceptable yield strengths but their moduli are probably still too low for satisfactory taping. Also, the dielectric properties of these materials may be slightly outside design specifications. The polycarbonate was found to possess completely acceptable mechanical properties but its loss tangent appears to be much too high. As part of an effort to optimize the characteristics of these films, corrective action was initiated in several ways. Experimental samples of Makrofol will be prepared with reduced concentrations of solvent, dyes, and other additives in order to reduce the loss tangent and dielectric constant of this material. Modifications will be made to the polymerization and extrusion processes of polyethylene, polyamide, and polysulfone in order to improve the moduli, yield and tensile strengths of these films. Finally, blends of polyethylene with other polymers are being fabricated in order to increase the cryogenic ductility of this film. Once an acceptable short-term design of insulation is achieved many problems will remain. In particular mechanisms of long-term degradation must be investigated, a topic which has received little attention for materials at cryogenic temperatures. (auth)

19579 (BNL-19849) CONSIDERATIONS OF VOLTAGE DROP AND LOSSES IN THE DESIGN OF HELICALLY-WOUND SUPERCONDUCTING AC POWER TRANSMISSION CABLES. Morgan, G.; Forsyth, E. B. (Brookhaven National Lab., Upton, N. Y. (USA)). 1975. 15p. (CONF-750716-3). Dep. NTIS $4.00.

From international cryogenic materials conference; Kingston, Ontario, Canada (22 Jul 1975).

Flexibility in a cable made using brittle superconductors is obtained by winding the superconductor and electrical insulation in the form of concentric helices. The axial stress due to contraction during cooldown of a helix which is rigidly attached at each end is reduced compared to a seamless tube. The radial contraction of the conductor is adjusted by selection of the pitch to match the greater contraction of the dielectric material. A choice of pitch for a simple helix which satisfies the contraction condition will, in general, generate an axial field in its interior which causes heating in any normal metal there, induces currents in metal surrounding the cable (e.g., armor) and causes an inductive voltage drop in the shield helix. A general expression for the self and mutual inductances of concentric helices is given and it is shown that the only configuration which minimizes heating and voltage drop consists of a core and shield each wound from a double helix, one inside the other and having almost equal pitches but opposite sense of winding. Normal metal stabilizing for the superconductor, if present, must either be coated with superconductor, or appear in the form of additional double helices inside the core and outside the shield. (auth)

19580 (ERDA-tr-35) CALCULATION, COMPARISON, AND OPTIMIZATION OF THE MAGNET SYSTEMS OF SUPERCONDUCTING INDUCTIVE ENERGY STORAGE DEVICES WITH DIFFERENT GEOMETRIC SHAPES. Egorov, S. A.; Kostenko, A. I. 1974. Translated by W. J. Grimes from Induktivnyye Nakopiteli Energii i Kommutatsionnaya Apparatura Dlya Termoyadernykh Ustanovok. (CONF-741238-2). 132p. Dep. NTIS $9.75.

From joint USSR-USR seminar; Leningrad, USSR (9 Oct 1974).

The most advantageous method of generating the powerful electrical impulses required for powering experimental thermonuclear installations is to use superconducting inductive energy storage devices. Beginning at an energy of 10^7 joules and up, these devices are more economical than capacitor batteries. In the near future, it will be necessary to develop and build these devices with a stored energy of 10^8 to 10^{10} joules. The problems of designing and comparing magnetic systems and selecting their optimal geometry, ensuring the minimum cost of semiconductor material per unit of stored energy are discussed. (TFD)

19581 (FRNC-TH-518) THERMAL BEHAVIOR OF AN IMPREGNATED SUPERCONDUCTING COIL IN VARIABLE OPERATION. Fevrier, A. (Paris-11 Univ., 91- Orsay (France)). 1974. 77p. (In French). INIS.

A theoretical and experimental study on the thermal behavior of an impregnated superconductor coil working under variable conditions is described. The general heat equations governing the phenomenon are recalled and it is shown that, given a few approximations in the quantitative effects, the thermal equation may be linearized. Thus the temperature field at the surface of the superconductor was determined by a development in series, the various coefficients depending on the cable structure and the loss of power density. A computing program was established to calculate the surface temperature of the superconducting material at all times and on all points of an impregnated coil. The thermal conductivity tensor variations of the composite material as a function of temperature and magnetic induction were obtained for coppers of different purities. The various parameters govern-

ing heat transfer to liquid helium were also determined (interface orientation, pressure of the helium bath, boiling conditions, magnetic induction). The above theoretical and experimental results were used to determine the thermal behavior of a particular coil, the dipolar magnet " MOBY", under pulsed conditions. The thermal behavior of MOBY when losses are due exclusively to radiations (constant current) was calculated and the importance of cooling in this mode of operation was observed. The computing program served to define a composite with Nb-Ti as superconductor able to work at the industrial frequency of 50 Hz. (FR)

19582 (JUL-1132-SE) BASIC STUDIES ON APPLICABILITIES OF SUPERCONDUCTING SWITCHES IN CRYOGENIC ENERGY TECHNOLOGY. Grawatsch, K. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Systemforschung und Technologische Entwicklung; Technische Hochschule, Graz (Austria)). Nov 1974. 215p. (In German). INIS.

With figs. and tabs.; 41 refs.

The possible uses of superconductive switch elements are thoroughly investigated. The possible ranges of application are defined, and some fields of application are described in more detail. (GE)

19583 (LA-UR-75-1099) EVALUATION OF PRE-IMPREGNATED RESIN-GLASS SYSTEMS FOR INSULATING SUPERCONDUCTING MAGNETS. Schermer, R. I. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-ENG-36. 14p. (CONF-750716-6). Dep. NTIS $4.00.

From international cryogenic materials conference; Kingston, Ontario, Canada (22 Jul 1975).

Superconducting magnets using adiabatically stable conductors may be fabricated using a resin-glass insulating system applied to the conductor before winding and cured after winding. Preliminary screening for strength and convenience of use has been performed on seven possible candidate systems. Results are presented for butt-tensile tests at 300°K and 77°K and a description is given of the physical handling characteristics for each system. (auth)

19584 (SAND-75-5674) MULTIMEGAJOULE PULSED POWER GENERATION FROM A REUSABLE COMPRESSED MAGNETIC FIELD DEVICE. Cowan, M.; Cnare, E. C.; Tucker, W. K.; Wesenberg, D. R. (Sandia Labs., Albuquerque, N. Mex. (USA)). [nd]. 4p. (CONF-741163-2). Dep. NTIS $4.00.

From international conference on energy storage, compression and switching; Asti, Italy (5 Nov 1974).

A pulsed power system is described which is potentially capable of producing multimegajoule pulses with millisecond rise time and repetition rates of more than one per second. A metallic piston is driven by gas combustion through axially aligned coils which are originally energized with relatively small magnetic energy. Experimental results are presented for a pulse generator of this kind which utilized a piston of 20 MJ kinetic energy, and comparison is made with predictions of a numerical model. (auth)

19585 LIQUID HELIUM CRYOSTAT FOR ELECTRON RADIATION DAMAGE AND ANNEALING STUDIES. Kitagawa, M.; Bryant, F. J.; Norman, E. Annu. Rep. Radiat. Center Osaka Prefect.; 15: 55-57(1974).

A liquid helium cryostat which has convenient features for studying electron-radiation damage effects in semiconductors is described. The cryostat has two liquid helium dewars and a liquid nitrogen dewar shielding them against thermal radiation. The liquid helium dewars are smoothly rotatable on a vertical axis together with the copper cold finger in order to face the sample with electron beam during irradiation or with magnetic flux in Hall effect measurements. A mechanical valve allows the flow of liquid helium to be interrupted so that the sample may be kept at required higher temperatures for annealing experiments while maintaining liquid helium in the main dewar. (auth)

19586 SYSTEM PERFORMANCE CHARACTERISTICS OF SUPERCONDUCTING ALTERNATORS FOR ELECTRIC UTILITY POWER GENERATION. Einstein, T. H. (M.I.T. Lincoln Lab., Lexington, MA). IEEE (Inst. Electr. Electron. Eng.) Trans. Power Appar. Syst.; PAS-94: No. 2, 310-319(1975).

From IEEE PES summer meeting and energy resources conference; Anaheim, CA (14 Jul 1974).

This paper reviews the reasons for the low synchronous reactance attributable to the use of superconducting field winding, and compares the expected performance characteristics of a superconducting alternator in the 1000 MVA range with those of a conventional power system generator of comparable rating. Among the specific topics discussed are performance with regard to dynamic stability, transient stability, voltage regulation, and excitation control. The principal operational advantages of a superconducting alternator appear to be (1) the absence of a dynamic stability limit within its MVA capability, (2) significantly greater transient stability when operating at leading power factors, (3) superior voltage regulation, and (4) no degradation of dynamic stability due to automatic voltage regulator action. Consequently, superconducting alternators appear to be ideally matched to modern power system applications that require operation of generators at leading power factors. (auth)

19587 TRANSIENT STABILITY OF SUPERCONDUCTING ALTERNATORS. Furuyama, M.; Kirtley, J. L. Jr. (Massachusetts Inst. of Tech., Cambridge). IEEE (Inst. Electr. Electron. Eng.) Trans. Power Appar. Syst.; PAS-94: No. 2, 320-328 (1975).

From IEEE PES summer meeting and energy resources conference; Anaheim, CA (14 Jul 1974).

A simulation study is performed for the purpose of determining the transient stability characteristics of superconducting alternators. This simulation is compared with an equal area criterion method. It is found that superconducting machines have good transient stability characteristics, that field forcing is not particularly helpful nor necessary. It is also found that the equal area criterion is useful for computing critical clearing times, if voltage behind subtransient reactance is held constant. (auth)

19588 SLIDING SUPERCONDUCTING CONTACT. Blackford, B. L.; Purcell, C. J.; Stroink, G. (Dalhousie Univ., Halifax, Nova Scotia). Cryogenics; 15: No. 5, 283-284(May 1975).

It has been found that solder coated spring wire brushes can make a sliding superconducting contact with a rotating superconducting commutator. With a relative velocity of 0.5 cm s^{-1} between brushes and rotor, critical currents of up to 0.1 A are observed. Below the critical current no resistance above 10^{-7} Ω is detected. (auth)

19589 TECHNICAL AND ECONOMIC FEASIBILITY OF SUPERCONDUCTING POWER TRANSMISSION: A CASE STUDY. Forsyth, E. B. (Brookhaven National Lab., Upton, NY); Mulligan, G. A.; Beck, J. W.; Williams, J. A. IEEE (Inst. Electr. Electron. Eng.) Trans. Power Appar. Syst.; PAS-94: No. 1, 161-170(1975).

From IEEE PES summer meeting and energy resources conference; Anaheim, CA (14 Jul 1974).

The long-range plans of the Long Island Lighting Company include the installation of 4600 MW of generation capacity at nuclear sites on eastern Long Island by the 1990's. A single site, Shoreham, was chosen for this study which would require transmission facilities to the Ruland Road substation, 43 miles away. Conventional 345 kV overhead and underground circuits are planned for this service. For the case study three superconducting cable schemes have been investigated which reflect various technical options. The superconducting cables have been designed to meet acceptable normal and contingency load flow conditions and to withstand maximum short circuit faults. A cost analysis has been made of the complete installation, providing a valuable comparison of the estimated cost of this new technology with conventional methods. The most favorable cost comparison is a two-circuit 345 kV superconducting system, which appears to be about one-half the cost of an all underground 345 kV high pressure oil-filled cable system. No reactive compensation will be required for the superconducting system, whereas extensive compensation is required for HPOF cables over the same distance. The cost estimate for the two-circuit superconducting system is about twice that of 345 kV overhead transmission, which would consist of two double circuits and one single circuit, assuming right-of-way could be obtained. (auth)

19590 CONTINUOUS RECORDING OF MAGNETIZATION CURVES BY MEANS OF SUPERCONDUCTING DEVICES. Eckert, D.; Hesske, R. R.; Lange, F. (Zentralinstitut fuer Festkoerperphysik und Werkstofforschung, Dresden). Exp. Tech. Phys.; 22: No. 6, 617-621(1974). (In German).

A magnetometer is described, which allows the continuous recording of magnetization curves on a x–y-recorder also in the case of low velocity of field change. Very low drift is attained by the application of a superconducting flux transformator and automatic compensation. High sensitivity follows from the use of a superconducting quantum interferometer as a null detector. (auth)

19591 HEAT OPERATED CRYOGENIC ELECTRICAL GENERATOR. Fletcher, J. C.; Wang, T. C.; Saffren, M. M.; Elleman, D. D. US Patent 3,875,435. 1 Apr 1975. Filed date 1 Apr 1974. 8p.

An electrical generator useful for providing electrical power in deep space, is disclosed. The subject electrical generator utilizes the unusual hydrodynamic property exhibited by liquid helium as it is converted to and from a superfluid state to cause opposite directions of rotary motion for a rotor cell thereof. The

physical motion of said rotor cell is employed to move a magnetic field provided by a charged superconductive coil mounted on the exterior of said cell. An electrical conductor is placed in surrounding proximity to said cell to interact with the moving magnetic field provided by the superconductive coil and thereby generate electrical energy. A heat control arrangement is provided for the purpose of causing the liquid helium to be partially converted to and from a superfluid state by being cooled and heated, respectively. (auth)

19592 NOISE IN THE rf SQUID. Jackel, L. D.; Buhrman, R. A. (Cornell Univ., Ithaca, NY). J. Low Temp. Phys.; 19: No. 3-4, 201-246(May 1974).

The results of an extensive study of the sensitivity-limiting noise sources in rf-biased SQUID flux detectors are presented. The investigation included both experiments with point contact and thin-film SQUIDs and digital computer simulations. A discussion of rf SQUID operation is presented, with special emphasis on those aspects that determine flux detector sensitivity. The origin and consequences of intrinsic device noise in rf SQUID systems are discussed. A straightforward technique for determining intrinsic noise amplitude directly from SQUID rf I-V characteristics is outlined. Deviations in the measured intrinsic noise of many devices from the Kurkijarvi-Webb prediction are attributed to departures from the ideal Josephson sinusoidal current-phase relation in the SQUID weak link. Kurkijarvi's SQUID tank circuit noise analysis is reviewed. It is shown that SQUID sensitivity can be maximized by an optimal coupling between SQUID ring and tank circuit. This optimal coupling depends upon circuit parameters, ring inductance, and weak-link properties. The analysis reveals that variations in the current-phase relation can result in a difference of as much as a factor of ten in the attainable sensitivity of two otherwise identical SQUID systems. Efforts in circuit design that are most likely to lead to further improvements in flux detector sensitivity are suggested. Finally, other factors, including external magnetic noise and underdamping of the SQUID ring, are discussed. (auth)

19593 IMPROVEMENTS RELATING TO DYNAMO-ELECTRIC MACHINES. Warne, D. F.; Hadlow, M. E. G. (to Electrical Research Association Ltd.). British Patent 1,387,837/B/. 19 Mar 1975. Filed date 29 Dec 1971. 7p.

Reference is made to dynamo-electric machines having superconducting windings, the advantages of which are enumerated. The machine described has a field winding comprising at least two concentric cylindrical air-cooled coils connected for supply by direct currents flowing in opposite directions and cooled to render them superconducting. The coils have different diameters and are spaced radially to leave an annular space that encloses a non-rotary armature comprising a number of arcuate portions each having arcuately extending conductors and each connected to a reciprocating mechanism permitting reciprocation in a radial direction within the annular space between the field coils. An axial magnetic flux concentrated within the annular space is produced, and the difficulties associated with a rotary armature are avoided. The movement of the armature portions in a radial direction causes generation of a sinusoidal emf in each conductor that intercepts the field flux at right angles. Transmission of power to or from the reciprocating armatures may be achieved by sliding contacts or inductive coupling, but it is preferable to use flexible conductors. Single phase of three phase operation is described. The addition of a further coil, of diameter either smaller or larger than either of the first two, leads to the production of a second uniform magnetic field in the second annular space provided. For this purpose the direction of current flow in each coil must be opposite to that in the coil next to it. The reciprocating mechanism may comprise a central shaft with a crank connected to each portion of the armature. Arrangements for achieving the necessary superconductivity in the field windings are described. The windings should consist of an appropriate material, such as Nb-Ti or Nb-Sn, which may be backed with or embedded in a matrix material such as Cu or Al. (UK)

19594 CALCULATING THE MAGNETIC FIELD OF A SPHERICAL SUPERCONDUCTING SUPPORT. Gorshkov, V. A. (Moscow Aviation Inst.). Izv. Vyssh. Ucheb. Zaved., Priborostr.; 17: No. 7, 89-92(1974). (In Russian).

The problem of analyzing the magnetic field surrounding a spherical superconducting body frequently arises in the development of superconducting supports for cryogenic navigation instruments and devices, since many of the support's main parameters depend on the spatial distribution of this field. A method of plotting the stress sheets of the magnetic field on the surface of a superconducting sphere located in the field is discussed. In order to simplify the computations, axial symmetry of rotation of the field is discussed. The author represents the square of the intensity of the magnetic field on the body's surface in quadratic form, as the coefficients of the Fourier expansion of the scalar potential of the magnetic field generated by a system of sources. When these coefficients are given, the stress sheet of the magnetic field's intensity on the sphere's surface can be computed by using an algorithm given in the article. (JPRS)

19595 SUPERCONDUCTIVE SOLENOID OF NIOBIUM STANNIDE OF 104,000 OERSTEDS. Bashilov, V. A.; Kunakov, Ya. N.; Bulynin, V. L.; Mel'nikov, V. I.; Gripas, Yu. N.; Gerasimov, L. N.; Belov, A. V. pp 93-95 of Struktura i Svoystva Sverkhprovodyashchikh Materialov. Moscow; Izdatel'stvo Nauka (1974). (In Russian).

Results of tests of a single-section solenoid with magnetic field strength of 1.04×10^5 oersteds [8.28×10^6 A/m] (at 4.2°K) made of superconductive Nb_3Sn copper-stabilized tape are given. The use of ferromagnetic concentrators enables one to increase H_k to 1.24×10^5 oersteds (9.87×10^6 A/cm). (Ref. Zh.)

Heat Transfer and Fluid Flow

Refer also to abstracts 21435, 21436, 21447, 21448, 21463, 21521, 21625, 21701–21704, 21709, and 21741.

19596 (CONF-730578-) FIRST AUSTRALASIAN CONFERENCE ON HEAT AND MASS TRANSFER, MONASH UNIVERSITY, MELBOURNE, AUSTRALIA, MAY 23–25, 1973. (Monash Univ., Clayton (Australia)). 1973. 665p.

Seventy-six papers were presented at the heat and mass transfer conference. A separate abstract was prepared for one paper. The remaining 75 papers were not within the scope of NSA. (LCL)

For an abstract of an individual paper see: 19597.

19597 (CONF-730578-, pp 33-38, Sect. 4.4) UTILIZATION OF FLUID TEMPERATURE FLUCTUATIONS TO ASSESS THE THERMAL PERFORMANCE OF HEAT EXCHANGE EQUIPMENT. Mumme, I. A.; Lawther, K. R. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). 1973.

From 1st Australasian conference on heat and mass transfer; Melbourne, Australia (23 May 1973).

In first Australasian conference on heat and mass transfer.

A technique is described for measuring overall heat transfer coefficients for gas flow through assemblies with complex solid/fuel heat transfer surfaces. The method utilises flow induced temperature fluctuations, inherent in the system, so heating equipment is not required. This method involves an analysis of temperature data from fast response platinum resistance thermometers, placed upstream and downstream of the heat transfer appliance. As an example, the use of the technique to compare the performance of a tube bundle with and without turbulence promoters is described. Experimental data obtained using both the inherent temperature fluctuations technique and the more established cyclic temperature method were in close agreement. (auth)

19598 (GKSS-75/E/7) MEASUREMENTS OF FLOW-RATE TRANSIENTS IN ONE-PHASE LIQUID FLOW. Mueller-Roos, J. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (F.R. Germany). Inst. fuer Werkstofftechnologie). 1975. 51p. (In German). INIS.

23 figs.; 10 refs.

A report is given on a method to determine flow-rate transients in a one-phase flow. Periodic temperature signals are superposed on the flow, from which flow times are calculated through correlation each over a half period. The evaluation is carried out according to the digitalization "off-line" on a large computer. Rate peaks over 100% within 1.9 s were qualitatively and quantitatively well represented. (GE)

19599 (IFA-FR-119-1974) NON-LINEARITIES OF HEAT TRANSFER IN THE BOUNDARY LAYER. Popescu, C.; Boeriu, S.; Biro, L.; Turcu, I. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 18p. (In Romanian). INIS.

This paper qualitatively studies the local value of the thermal flux for a non-linear heat transfer in the boundary layer. Considering the temperature variation of the physical properties, the transfer equations are solved by numerical methods in two different cases: for very high Prandtl numbers and for very low Prandtl numbers. The local value of the thermal flux is pointed out to be different from the linear heat transfer case. (auth)

19600 (SAND-75-8610) NATURAL CONVECTION OF A HEAT-GENERATING FLUID WITHIN CLOSED VERTICAL CYLINDERS AND SPHERES. Kee, R. J.; Landram, C. S.; Miles, J. C. (Sandia Labs., Livermore, Calif. (USA)). Apr 1975. Contract AT(29-1)-789. 17p. (CONF-750804-8). Dep. NTIS $4.00.

From conference on heat transfer; San Francisco, California, USA (11 Aug 1975).

Steady natural convective flow fields were numerically and experimentally characterized for 0.7 Prandtl number fluids having constant, uniformly distributed, internal heat sources. The bounding isothermal walls containing the fluid were considered to be either a sphere or a cylinder of finite height. An instrumented cylinder containing radioactive tritium gas was used to demonstrate experimental and analytical agreement for local temperatures over a range of Grashof numbers. For the spherical geometry, a generalized correlation was obtained for the surface-averaged Nusselt number as a function of a modified Grashof number. (auth)

19601 HEAT TRANSFER IN THE ENTRANCE SECTION OF A PIPE WITH A TWO-PHASE FLOW. Kapinos, V. M.; Slitenko, A. F.; Chirkin, N. B.; Povolotskii, L. V. Heat Transfer—Sov. Res.; 7: No. 2, 126-128(1975).

Translated from Izv. Akad. Nauk SSSR, Energ. Transp.; 1: 173-175(1974).

The heat transfer in the entrance section of a vertical circular pipe, through which there is a flow of air bearing suspended drops of a fluid, was investigated. It was found that the pipe length required for heat transfer stabilization is 30d, assuming an average heat transfer coefficient. An empirical relationship is derived to permit calculation of the heat transfer in the accelerating section. (auth)

19602 ACOUSTICAL INVESTIGATION OF CRITICAL HEAT FLUX DENSITIES IN POOL BOILING OF WATER. Kichigin, A. M.; Povsten. (Engineering Thermophysics Inst., Kiev). Heat Transfer—Sov. Res.; 7: No. 2, 74-77(1975).

Translated from Teplofiz. Teplotekh.; 24: 60-63(1973).

Frequency analysis of noise accompanying boiling was used to determine critical heat flux densities in pool boiling of water on horizontal cylindrical surfaces at pressures of 0.098 to 0.49 × 10^6 Newtons/m^2 and subcoolings of 5 to 100°C. The data fit a semiempirical formula. (auth)

19603 CRITICAL HEAT FLUXES IN ANNULI WITH SWIRL. Ornatskii, A. P.; Chernabaii, V. A.; Vasil'yev, A. P.; Perkov, S. V. (Kiev Polytechnic Inst.). Heat Transfer—Sov. Res.; 7: No. 2, 6-9(1975).

Translated from Teplofiz. Teplotekh.; 24: 36-39(1973).

Critical heat flux densities were investigated in concentric annuli 160, 270 and 450 mm long with and without induced swirl at the inlet, as well as with different locations of the swirl generator relative to the inlet (in the 450 mm long annulus). The pressures were 98.1, 147.2 and 186.5 bar and water mass flowrates were 500, 1000, and 1700 kg/m^2-sec. It was found that the effect of flow swirling on the critical heat flux depends on flow conditions and geometric parameters. (auth)

19604 HEAT TRANSFER, 1974. Volume I. Proceedings of the Fifth International Heat Transfer Conference, Held September 3—September 7, 1974, in Tokyo, Japan. Washington, DC; Scripta Book Company (1974). 289p. (CONF-740925—P1).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974).

Fifty-six papers presented at the heat transfer conference are included in this volume. A separate abstract was prepared for each of 3 papers. The remaining 52 papers were not within the scope of NSA. (LCL)

For abstracts of individual papers see: 19605, 19606, and 21463.

19605 ANALYTICAL METHOD ON COMPOSITE HEAT TRANSFER WITH PREDOMINANT RADIATION: ANALYSIS BY INTEGRAL EQUATION AND EXAMINATION ON RADIATION SLIP. Echigo, R.; Kamiuto, K.; Hasegawa, S. (Kyushu Univ., Fukuoka). pp 103-107 of Heat Transfer, 1974. Vol. 1. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P1.

An analytical method is presented on heat transfer by simultaneous convection and radiation at high or extremely high temperature. An analytical method developed here is based on the integral equation by iterative means, correcting the convective and conductive terms in energy equation, and it is demonstrated that the convergence of iterative solutions is facilitated as the radiation effect increases. Numerical calculations are performed on composite heat transfer by simultaneous radiation and convection in a fully developed laminar flow between parallel flat plates. Further, the radiation slip in composite heat transfer without heat conduction is examined in some detail. (auth)

19606 AUGMENTATION ON HEAT TRANSFER BY THERMAL RADIATION SHIELDING PLATE PLACED IN A DUCT. Hasegawa, S.; Echigo, R.; Ichimiya, K.; Kamiuto, K. (Kyushu Univ., Fukuoka). pp 108-112 of Heat Transfer, 1974. Vol. 1. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P1.

The heat transfer analysis for the parallel planes, in which the thermal radiation shielding plate is installed at the center, is performed when the flowing medium is radiating gas as well as non-radiating gas. The results of temperature profiles obtained by numerical procedure are summarized for the dimensionless parameter denoting the role of conduction to radiation and the dimensionless coordinate of flow direction, and the heat transfer characteristics are examined in some details, especially regarding the augmentative effect by using the shielding plate, and it is recognized that the installation of thermal radiation shielding plate is an effective augmentation device for high temperature systems. (auth)

19607 HEAT TRANSFER, 1974. Volume II. Proceedings of the Fifth International Heat Transfer Conference, Held September 3—September 7, 1974, in Tokyo, Japan. Washington, DC; Scripta Book Company (1974). 396p. (CONF-740925—P2).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974).

Seventy-seven papers presented at the heat transfer conference are included in this volume. A separate abstract was prepared for each of 6 papers. The remaining 71 papers were not within the scope of NSA. (LCL)

For abstracts of individual papers see: 19608—19613.

19608 MONTE CARLO CALCULATION OF TURBULENT MIXING IN A ROD BUNDLE. Hetsroni, G. (Carnegie-Mellon Univ., Pittsburgh); Mor, A.; Solan, A. pp 137-140 of Heat Transfer, 1974. Vol. 2. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P2.

A Monte Carlo program for the calculation of heat transfer in turbulent channel flow, with special application to rod bundle channels, is described. The Monte Carlo calculations were compared with conventional alternating-directions-implicit numerical solutions. The results show that the conventional method is more economical of computer time for moderate grid sizes, whereas the Monte Carlo method is practical for very large sizes, which are beyond the capacity of conventional methods. (auth)

19609 FORCED CONVECTION HEAT TRANSFER IN AN ANNULUS. Furber, B. N.; Appleby, G. G.; Facer, R. I. (Nuclear Power Group Ltd., Risley, Eng.). pp 155-159 of Heat Transfer, 1974. Vol. 2. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P2.

Experimental work to determine local heat transfer coefficients and overall pressure drop data for two annular channels of diameter ratio 1.47 and 1.20 is described. Tests in helium and nitrogen were carried out at annulus Reynolds numbers of 10^4 and 2 x 10^4 with further tests in nitrogen only at 10^5. Surface to bulk gas temperature ratios up to 1.8 were investigated. The test conditions chosen were influenced by high-temperature gas-cooled reactor design requirements. (auth)

19610 HEAT TRANSFER AND PRESSURE DROP MEASUREMENTS IN COOLING CHANNELS WITH HELIUM AT A PRESSURE OF 20 BAR AND WITH WALL TEMPFRATURES UP TO 1000°C. Petersen, H.; Kaiser, N. E. (Danish Atomic Energy Commission, Riso). pp 160-164 of Heat Transfer, 1974. Vol. 2. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P2.

In a closed, high-temperature gas loop 4 cooling channels were tested. Channel Nos. 1, 2, and 3 were of circular cross section, Nos. 1 and 2 with an internal diameter of 1.2 cm and length 4 m, No. 3 with 1.7 cm diameter and length 3.1 m. Channel No. 4, with a length of 1.7 m, had a flow cross section of trefoil shape. The Reynolds Number ranged from 2,000 to 70,000. The ratio of absolute temperature of the heated surface to gas bulk temperature was varied from 1.1 to 1.6. One hundred sixty (160) runs were performed. In the data analyses, comparisons were made with empirical equations for local heat transfer and pressure drop. (auth)

19611 FORCED CONVECTIVE HEAT TRANSFER IN THE THERMAL ENTRANCE REGION OF A FINITE UNIFORM-HEAT-FLUX ROD BUNDLE. Zarling, J. P.; Min, T. C. (Michigan Technological Univ., Houghton). pp 203-207 of Heat Transfer, 1974. Vol. 2. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P2.

A method for determining the heat transfer characteristics in the thermal entrance region for a developed axial laminar flow through a circular shell containing a uniform-heat-flux rod bundle

is presented. It utilizes a small parameter series solution, employing the Leveque similarity variable, and accounts for both the curvature of the rods and the circumferential non-linearity of the velocity profile. The solution provides a lower bound to the turbulent Nusselt moduli and an upper bound to the rod temperature variation. Nusselt moduli for the rod bundle of several configurations are reported and discussed. Results compare favorably with published solutions to annuli and experimental data for rod bundles. (auth)

19612 FORCED CONVECTION HEAT TRANSFER IN THE TRANSITION FROM LAMINAR TO TURBULENT FLOW IN CLOSELY SPACED CIRCULAR TUBE BUNDLES. Panknin, W.; Jahn, M.; Reineke, H. H. (Institut fuer Verfahrenstechnik, Hanover). pp 325-329 of Heat Transfer, 1974. Vol. 2. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P2.

Distributions of heat transfer coefficients in axial heat exchangers, consisting of closely spaced tube bundles, were measured with a holographic interferometer. For the transition from laminar to turbulent flow (Re 500 to 5000) six different spacings were examined. In addition to the local differences, temporal variations could be observed. A theoretical calculation of the local heat transfer, using the finite difference method, is in good agreement with the experimental results. (auth)

19613 NON-STEADY-STATE HEAT TRANSFER OF FINNED SURFACE. Okamoto, Y.; Kameoka, T. pp 353-357 of Heat Transfer, 1974. Vol. 2. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P2.

For many purposes, the finned surface is being used to increase heat transfer. Heat exchangers and fuel elements of gas cooled nuclear reactors require the use of the finned surface for high flux heat transfer. The problem is analytically treated by deriving a non-steady-state equation of radiative and convective heat transfer of annular and radial fins in case of sudden change of the fin-root temperature or heat flux. The numerical solution of temperature distribution along the fin is obtained for several typical transient cases. (auth)

19614 HEAT TRANSFER, 1974. Volume III. Proceedings of the Fifth International Heat Transfer Conference, Held September 3—September 7, 1974, in Tokyo, Japan. Washington, DC; Scripta Book Company (1974). 332p. (CONF-740925—P3).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974).

Sixty-four papers on natural convection and condensation presented at the heat transfer meeting are included in this volume. A separate abstract was prepared for each of two papers. The remaining 62 papers were not within the scope of NSA. (LCL)

For abstracts of individual papers see: 19615 and 19616.

19615 NON-CLASSICAL FILM FREE CONVECTION IN SUPERFLUID LIQUID HELIUM II NEAR THE LAMBDA-POINT. Amar, R. C.; Soloski, S. C.; Frederking, T. H. K. (Univ. of California, Los Angeles). pp 1-4 of Heat Transfer, 1974. Vol. 3. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P3.

Non-classical free convection was investigated using simplified thin film approximations of the boundary layer equations for a disordered He II quantum liquid layer. The results of the model calculations are compared with heat flux data for the single horizontal cylinder (Ga; dia 1.2×10^{-3} m) and related previous work. Near the lambda-point the data agree satisfactorily with a simplified form of the Leonard–Clermont correlation modified for disordered diameter-independent convection. Data interpretation in terms of convection model results suggests a temperature-dependent controlling acceleration-circulation term. (auth)

19616 BASIC STUDY ON VAPOR SUPPRESSION. Kudo, A.; (Babcock-Hitachi Co. Ltd., Kure-shi, Japan); Egusa, T.; Toda, S. pp 221-225 of Heat Transfer, 1974. Vol. 3. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P3.

The condensation of steam jets in highly subcooled water was studied experimentally and theoretically. Steam was discharged downward into pool water through single straight nozzle. The length (height) of the vapor cone formed of continuous vapor phase was determined by photographs and temperature distributions. It increased 0.4 to 2.5 x d (d: nozzle diameter) with steam velocity at the nozzle exit, 120 to 640 m/s. The angles of divergence of jets were about 20 to 40^0. A turbulent diffusion model was proposed that the length of vapor cone was calculated from turbulent diffusion of heat in the mixing zone between the vapor cone and the surrounding medium. Calculated results were agreeable to experimental values. (auth)

19617 HEAT TRANSFER, 1974. Volume IV. Proceedings of the Fifth International Heat Transfer Conference, Held September 3—September 7, 1974, in Tokyo, Japan. Washington, DC; Scripta Book Company (1974). 373p. (CONF-740925—P4).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974).

Seventy-one papers presented at the heat transfer conference are included in this volume. A separate abstract was prepared for each of 41 papers. The remaining 30 papers were not within the scope of NSA. (LCL)

For abstracts of individual papers see: 19618—19649, 21436, 21447, 21448, 21521, 21701—21704, and 21741.

19618 AXIAL PROPAGATION OF FREE SURFACE BOILING INTO SUPERHEATED LIQUIDS IN VERTICAL TUBES. Grolmes, M. A.; Fauske, H. K. (Argonne National Lab., IL). pp 30-34 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

A unique free surface boiling phenomenon has been observed as a result of rapid depressurization of an initially saturated or slightly subcooled stagnant liquid column in the absence of wall and bulk nucleation sites. Closeup high-speed photographs of water, refrigerant-11, and methyl alcohol in tubes from 0.2 to 15 in. dia reveal that the initiation of violent free surface flashing (vapor plus entrained liquid) follows from the development of Marangoni-type surface waves. The rate of propagation of the flashing surface shows evidence of choked flow limitations and proceeds at a rate which is several orders of magnitude greater than surface evaporation (vapor only) alone. The onset of free surface flashing was found to be dependent upon both the degree of initial liquid superheat and the tube diameter. (auth)

19619 EFFECT OF SURFACE CONDITIONS ON BOILING CHARACTERISTICS. Lorentz, J. J. (Argonne National Lab., IL); Mikic, B. B.; Rohsenow, W. M. pp 35-39 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

A unified model relating surface variables to the nucleate pool boiling characteristics was developed. A simple vapor trapping mechanism was postulated and a geometrical model constructed for idealized conical cavities relating the effective radius for nucleation to cavity radius, cone angle and contact angle. This model for individual cavities was extended to the entire surface providing an expression for the cumulative site density in terms of geometrical parameters. A transient heat conduction model was experimentally verified for water and organics at atmospheric pressure and was incorporated into a unified expression showing explicitly the role of surface geometry and contact angle. (auth)

19620 INVESTIGATION OF NUCLEATE BOILING HEAT TRANSFER OF HELIUM. Grigoriev, V. A.; Pavlov, Yu. M.; Ametistov, E. V. (Moscow Power Engineering Inst.). pp 45-49 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

The results of experimental investigation of nucleate pool boiling of helium on the upwardfacing surface of cylindrical rods made of different materials are presented. Boiling heat transfer coefficients are shown to be the function of thermal properties of the heating surface material and to grow when the complex k/root a of a metal increases. On the basis of the analysis of the main internal characteristics of nucleate boiling-vapor bubbles growth rates and vaporization centers density-the correlation for prediction of boiling helium heat transfer coefficient was obtained, the nature of heating surface having been taken into account. (auth)

19621 INVESTIGATION OF VAPOUR BUBBLES EFFECT ON TEMPERATURE OF HEAT TRANSFERRING SURFACE AT NUCLEATE BOILING. Subbotin, V. I.; Sorokin, D. N.; Tzyganok, A. A.; Gribov, A. A. (Inst. of Physics and Power Engineering, Obninsk, USSR). pp 55-59 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

Temperatures measured on a heat transferring surface under and outside a vapor bubble during bubble growth and departure are presented. It was shown that both for single and interacting bubbles sufficient temperature drop on the heat transferring surface oc-

curred only on the contacting area of a bubble and a wall during bubble growth. Outside this area no significant temperature change on the surface was noticed. (auth)

19622 TRANSIENT SURFACE TEMPERATURE BEHAVIOR IN NUCLEATE POOL-BOILING NITROGEN. Swanson, J. L.; Bowman, H. F. (Northeastern Univ., Boston). pp 60-64 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

Local, transient boiler-surface temperature measurements were made in saturated nitrogen and related to the conventional steady-state heat flux-excess temperature behavior. Data was acquired in discrete power increments as the nucleate-boiling regime was traversed. Individual bubble-induced temperature oscillations exhibit a 4-stage process indicative of the presence of an evaporating microlayer, and increased in magnitude as the power level was raised. At approximately one-half peak power, bubble coalescence was observed which ultimately led to the first crisis condition. A digital computer-oriented data acquisition and processing system made possible both temperature and time expansions for visual analyses. (auth)

19623 EXPERIMENTAL DETERMINATION OF ISOLATED BUBBLE ACOUSTICS IN A NUCLEATE BOILING SYSTEM. Robinson, G. E.; Schmidt, F. W.; Block, H. R.; Green, G. (Pennsylvania State Univ., University Park). pp 75-79 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

The reflection-free pressure associated with the inception and growth of bubbles from an isolated site on a platinum wire is reported. The pressure, bubble radius, velocity and acceleration of the bubble wall are determined as a function of time from data recorded by high speed motion pictures. Using the differential momentum equation and the experimental pressure pulse data, the radius-time relationship is predicted. Conversely, using the same equation and the experimental radius versus time data, the pressure disturbance is calculated. Both predictions are in good agreement with the experimental data. The effect of system pressure and liquid subcooling on the magnitude and period of the pressure pulse is also shown. (auth)

19624 TEMPERATURE-CONTROLLED POOL-BOILING HEAT TRANSFER. Sakurai, A.; Shiotsu, M. (Kyoto Univ., Japan). pp 81-85 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

Characteristics of temperature-controlled pool-boiling heat transfer covering nucleate, transition and film boiling regions are studied for water at atmospheric pressure. A new computer-controlled experimental system is developed to realize stable operation in three boiling regions. Thermal hysteresis effects by increasing and decreasing heater temperature are found, for the first time, both in the nucleate boiling region and in the transition boiling region near the maximum heat flux point. Maximum heat flux of nucleate boiling and maximum heat flux of transition boiling are not the same. It is confirmed that the transition boiling is the combination of nucleate boiling and film boiling. (auth)

19625 REGRESSION ANALYSIS OF POST-CHF FLOW BOILING DATA. Mattson, R. J. (Atomic Energy Commission, Washington, DC); Condie, K. G.; Bengston, S. J.; Obenchain, C. F. pp 115-119 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

The successful application of statistical analysis in systematic investigations of heat transfer data for boiling water beyond the critical heat flux is described. Multiple linear regression analysis together with statistical tests of correlations and data were used in this study. Data from a number of experiments encompassing film and transition boiling in several geometries were correlated by boiling regime, by geometry, and in aggregate. Error estimates and uncertainty bounds were specified for all such correlations. (auth)

19626 PHENOMENOLOGICAL TRANSITION AND FILM BOILING HEAT TRANSFER CORRELATION. Tong, L. S.; Young, J. D. (Westinghouse Electric Corp., Pittsburgh). pp 120-124 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

The transition and film boiling heat transfer in a steady water flow is correlated on the basis of three important phenomena, namely, thermodynamic non-equilibrium, partial nucleate boiling and partial stable film boiling. The actual quality in a non-equilibrium flow is used in the correlation, while the degree of non-equilibrium was determined from the measured deviation of the superheat steam heat transfer behavior in the actual quality from the fictitious equilibrium quality. The agreement between the predictions of this correlation and the existing data is very good. (auth)

19627 TWO-PHASE FORCED-CONVECTIVE HEAT TRANSFER AT HIGH SUBCRITICAL PRESSURE. Sohns, J. (Univ., Stuttgart). pp 150-154 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

Two-phase forced-convective heat transfer was investigated in the reduced pressure range 0.31 less than pi less than 0.96 with ammonia as working fluid in a vertical tube. With small qualities as well as simultaneous high mass flow rates and system pressure it is suggested to use the dimensionless groups controlling turbulent heat transfer in tubes for a homogeneous two-phase flow model. It was possible to represent experimental data by a correlation of turbulent flow type. (auth)

19628 VOID FRACTION CORRELATION FOR VERTICAL AND HORIZONTAL BULK-BOILING OF WATER. Madsen, N. (Univ. of Rhode Island, Kingston). pp 185-189 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

Void-fraction data from three sources, obtained by three experimental methods, have been correlated semi-empirically. Assuming a continuous transition from bubbly to separate flow, an equation has been derived, expressing void fraction as a function of: density ratio of the phases, the quality, and the void fraction at the transition point from bubbly to churn or slug flow. This void fraction is 0.302 for all the data. The equation applies to water-air adiabatic and to water-steam diabatic systems inside round tubes, at pressures from atmospheric to 14480 kN/m^2, and qualities from 0.001 to 0.5. (auth)

19629 FRICTIONAL PRESSURE DROP AND CONVECTIVE HEAT TRANSFER OF GAS–LIQUID FLOW IN HORIZONTAL TUBES. Bandel, J.; Schlunder, E. U. (Univ., Karlsruhe, Ger.). pp 190-194 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

Our measurements of friction pressure drop and heat transfer for evaporating refrigerants in horizontal tubes were correlated by a new empirical method based on the corresponding single phase flow equations, which were extended by taking into account the interphase friction. A comparison of about 4000 friction pressure drop data in a wide range of two phase flow conditions showed the new method to cover all these data with a better accuracy than the methods of Lockhart-Martinelli and Chawla-Bankoff. (auth)

19630 STATISTICAL METHODS FOR MEASUREMENT AND ANALYSIS IN TWO-PHASE FLOW. Jones, O. C. Jr. (General Electric Co., Schenectady, NY); Zuber, N. pp 200-204 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

A fast response, linearized x-ray void measurement system has been used to obtain statistical measurements in normally fluctuating air-water flow in a rectangular channel. It is demonstrated that the probability density function (PDF) of the fluctuations in void fraction may be used as an objective and quantitative flow pattern discriminator for the three major patterns of bubbly, slug, and annular flows. This concept has been applied to data over the range of 0.0 to 120 fps mixture velocity to show that slug flow is simply a transitional, periodic time combination of bubbly and annular flows. Calculation of slug length and residence time ratios are readily obtainable from the statistical measurements. (auth)

19631 VISUAL STUDY OF AIR–WATER MIXTURES FLOWING INSIDE SERPENTINE TUBES. Farukhi, M. N.; Parker, J. D. (Oklahoma State Univ., Stillwater). pp 205-209 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

Hydrodynamic behavior of air-water mixtures flowing inside serpentine tubes, with bends in the vertical plane, was investigated. Flow visualization was accomplished by injecting dye into the liquid phase and recording the events on color slides and color movies. For certain combinations of gas and liquid flow rates, in the annular type flow regime, "film inversion" was

observed in the bend as well as in the straight section immediately downstream of the bend. A new flow regime map particularly applicable to two phase flow inside serpentine tubes is presented. (auth)

19632 UNSTEADY CHARACTERISTICS OF TWO-PHASE FLOW IN A HORIZONTAL TUBE EVAPORATOR. Saito, T.; Uchida, H.; Hiraoka, E. (Univ. of Tokyo). pp 210-214 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

The unsteady characteristics of a refrigerator such as the starting behavior or hunting phenomena were investigated. Experimental data were recorded on an oscillograph and compared with pictures taken to show flowing behavior of the refrigerant. The variations of temperature and film heat transfer coefficients were verified to each pattern of refrigerant flow, particularly the so-called slug flow. From visual observations and measured results the simplified model was obtained in order to consider transient phenomena of a refrigerator. (auth)

19633 STATISTICAL CHARACTERISTICS OF TEMPERATURE PULSATIONS WITHIN POST-BURNOUT REGION. Remisov, O. V.; Vorobyev, V. A.; Gribanov, Yu. I.; Sergeev, V. V. (Inst. of Physics and Power Engineering, Obninsk, USSR). pp 215-219 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

The experimental results of studies of statistical characteristics of temperature pulsations in a two-phase flow after dryout in post-burnout region are reported. The following statistical characteristics were investigated: intensity, probability distribution density, auto-correlation function and spectral density. Flow temperature pulsations were measured with microthermocouples. The tube was 10 mm in inner diameter; the pressure used was 137.3 bar for mass velocities of 350,000 and 700 kg/m^{2}s. The maximum of relative flow enthalpy in the experiments did not exceed DELTA H/r equals 2. (auth)

19634 CORRELATION BETWEEN OUTLET FLOWRATE AND MIXTURE-VAPOR TRANSITION POINT OSCILLATIONS IN TWO-PHASE EVAPORATING FLOW. Wedekind, G. L.; Beck, B. T. (Oakland Univ., Rochester, MI). pp 220-224 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

In two-phase evaporating flow with complete vaporization, outlet flowrate oscillations have been observed to accompany oscillations in the mixture-vapor transition point. Experimental evidence indicates an apparent coupling between these two oscillatory phenomena. A theoretical model is presented, which predicts a direct correlation between the outlet vapor flowrate oscillations and the oscillatory behavior of the transition point. The model has the capability of predicting this relationship on a statistical as well as an instantaneous basis, and is in good agreement with experimental data. (auth)

19635 IDENTIFICATION OF DYNAMIC CHARACTERISTICS IN TWO-PHASE AIR-WATER PARALLEL CHANNEL FLOW. Jovic, V.; Jovic, L.; Afgan, N. (Boris Kidric Inst., Belgrade). pp 230-234 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

Results are presented of the identification of dynamic characteristics in a two-phase air-water mixture in parallel channel flow. With use of the least square method for fitting the experimental results into three-parallel-channel adiabatic flow, the response function of pressure drop to inlet flow rate was obtained. By analyzing the transfer function, the criterion for the determination of the propagation velocity of density waves is developed. It is demonstrated that the propagation velocity depends on flow regimes in single channel flow. Special consideration is given to the propagation phenomena in parallel channel flow, and it is shown that the propagation velocity in the parallel channel flow is always higher than in the single channel flow. (auth)

19636 SUSTAINED AND TRANSIENT BOILING FLOW INSTABILITIES IN A CROSS-CONNECTED FOUR-PARALLEL-CHANNEL UPFLOW SYSTEM. Kakac, S.; Veziroglu, T. N.; Akyuzlu, K.; Berkol, O. (Middle East Technical Univ., Ankara). pp 235-239 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

The stability conditions and the modes of oscillation in a four parallel-channel upflow boiling system with cross-connections have been experimentally investigated using Freon-11 as the test fluid. Two major modes of oscillation, namely density-wave and pressure-drop type oscillations, have been observed. When two modes of oscillation occurred simultaneously some temperature oscillations were observed in most instances. Transient instabilities resulting from a step increase in power input and a step decrease in flow rate have also been investigated. The results have been compared with other boiling flow systems. (auth)

19637 STUDY OF MECHANISM OF BURNOUT IN A HIGH HEAT-FLUX BOILING SYSTEM WITH AN IMPINGING JET. Katto, Y.; Monde, M. (Univ. of Tokyo). pp 245-249 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

Nucleate boiling at very high heat fluxes was created on a heated surface covered with a flowing film of saturated water at atmospheric pressure being maintained by a small circular jet of water held at the center of the heated surface. It was found that increasing the heat flux led to a limiting state of flow where the splashing of droplets from the heated surface was no longer increased being kept constant until burnout appeared; and that there was a close relation between the burnout heat flux and the jet velocity. A flow model, which can explain the characteristics of this boiling system, is proposed. It is suggested that the burnout may be connected with the separation of a liquid flow from the heated surface accompanied with the effusion of vapor. (auth)

19638 CRITICAL HEAT FLUX FOR LARGE DIAMETER STEAM GENERATING TUBES WITH CIRCUMFERENTIALLY VARIABLE AND UNIFORM HEATING. Chojnowski, B.; Wilson, P. W. (Marchwood Engineering Labs., Southhampton, Eng.). pp 260-264 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

Critical heat flux data are presented for vertical steam generating tubes of 32 mm internal diameter subjected to circumferentially variable and uniform heat flux distributions. The test conditions were: pressure at 180 bar; mass flux of 700 to 1500 kg/m^{2}s; inlet-subcooled; bulk quality of 0.1 to +0.4; and heated length of 7.62 and 10.38 m. Information obtained showed that at nominally the same local conditions the critical heat flux was higher for the nonuniformly heated tube, the difference being greatest at low qualities and at low mass flux levels different trends were exhibited. The results were also used to assess two published correlations. (auth)

19639 OCCURRENCE OF UPSTREAM DRYOUT IN UNIFORMLY HEATED CHANNELS. Groeneveld, D. C. (Atomic Energy of Canada Ltd., Chalk River, Ont.). pp 265-269 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

At mass flows greater than 4000 kg/m^{2}s and qualities between 8 percent and 45 percent, dryout was observed in Freon-12 upstream from the outlet end of a uniformly heated tubular test section. Upstream dryout has also been observed during other high mass flow experiments: in Freon-12 in multi-rod bundles at the above conditions and in steam-water in tubes at Freon equivalent conditions. Upstream dryout is postulated to occur as a consequence of deterioration of the heat transport properties near the wall in the high mass velocity froth flow regime. (auth)

19640 CRITICAL HEAT FLUX IN INCLINED AND VERTICAL SMOOTH AND RIBBED TUBES. Watson, G. B. (Babcock and Wilcox Co., Alliance, OH); Lee, R. A.; Wiener, M. pp 275-279 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

An important design parameter for boiler tubes in high pressure natural circulation steam generators is the geometry of the flow circuit. The experimental results presented show that the critical heat flux (CHF) for a smooth tube decreases as the angle of inclination of the tube is decreased. However, a significant increase in heat flux or steam quality occurs for the ribbed tube when compared to the smooth tube at similar operating conditions. Also, the angle of inclination has little effect on the CHF at certain operating conditions. The improvement in the CHF for the ribbed tube is due to a swirling action promoted by the ribbing and was found to be dependent upon mass velocity. (auth)

19641 BURNOUT POWER IN ONCE-THROUGH TUBULAR STEAM GENERATORS. Campolunghi, F. (CNEN, Rome); Cumo, M.; Ferrari, G.; Leo, R.; Vaccaro, G. pp 280-284 of

Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

The present experimental research provides experimental data in a design field where existing burnout correlations are usually extrapolated outside their validity range. Low surface heat fluxes and very long geometries typical of L.M.F.B.R. sodium heated steam generators require full scale water tests. 218 burnout qualities at pressures ranging from 60 to 160 kg/cm^2 and specific mass flowrates from 110 to 260 g/cm^{2}s were measured and tested against the most known burnout correlations. Physically it appears that burnout quality is substantially independent from the flowrate, while a sharp subdivision with pressure suggest that for 60 less than p less than 90 kg/cm^2 and 110 less than p less than 160 kg/cm^2 two different burnout mechanisms may set up. (auth)

19642 HEAT TRANSFER CRISIS AT THE STEAM-WATER FLOWING IN CHANNELS IN HIGH STEAM CONTENT ZONES. Borishanskii, V. M.; Andreevskii, A. A.; Bykov, G. S.; Shleifer, V. A.; Lebedev, M. E.; Belenky, M. J. pp 285-289 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

A model of the heat transfer crisis of the second type is considered. The equation for the estimation of the film liquid flow rate and the intensity of drop separation from the flow core to the film is obtained. The calculated critical heat loads are compared with the experimental results in the range of pressure change from 20 to 125 bar, mass velocities from 500 to 4000 kg/m^{2}s and channel diameters from 8 to 18 mm. (auth)

19643 CALCULATION OF CRITICAL HEAT FLUX IN FORCED CONVECTION BOILING. Whalley, P. B.; Hutchinson, P.; Hewitt, G. F. (Atomic Energy Research Establishment, Harwell, Eng.). pp 290-294 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

A method of calculating critical heat flux in forced convective boiling in vertical up-flow in round tubes is presented. The heat flux is assumed to be uniform. Results of the calculation are compared with experimental results for a variety of fluids including water at various pressures, and fluorinated hydrocarbons. Very encouraging agreement with experiment is found. The calculation method assumes that the two-phase mixture of liquid and vapour form an annular type of flow. The burnout point is calculated as that at which the liquid film flow rate becomes equal to zero. (auth)

19644 EFFECT OF TRANSIENT FLOW ON PREMATURE DRYOUT IN TUBE. Ishigai, S. (Univ., Osaka); Nakanishi, S.; Yamauchi, S.; Masuda, T. pp 300-304 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

The influence of abrupt flow change on the critical heat flux in the high quality steam-water two-phase flow was studied mainly by experiments. The measured reduction in the critical heat flux is compared with the result of a simplified analysis based on the kinematic wave theory and the film vanishing hypothesis. It is concluded that the reduction is due to "premature dryout" caused by the deceleration of the liquid film. (auth)

19645 INCIPIENT SUPERHEAT IN A CONVECTIVE SODIUM SYSTEM. Henry, R. E.; Singer, R. M.; Quinn, D. J.; Jeans, W. C. (Argonne National Lab., IL). pp 305-309 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

Experimental measurements are reported for incipient boiling superheats in a convective sodium system. The results show that definitive evaluation of the incipient wall superheat requires a knowledge of the location of inception and detection of any entrained noncondensable gas bubbles. It is shown that, when history and gas solubility effects are properly accounted for, a reentrant cavity model is representative of the data. (auth)

19646 CONTRIBUTION TO THE BOILING NUCLEATION MECHANISM ON HEATED SURFACES FOR LIQUID METALS. Kottowski, H. M.; Grass, G.; Spiller, K. H. (EURATOM-CCR, Ispra, Italy). pp 310-314 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

The basic phenomena of boiling nucleation is discussed. The nucleation is primarily a process of void formation in the liquid, i.e., the local energy fluctuation has to be intense enough to provoke vacancies in the molecular lattice structure of the liquid, on which bubble formation can occur. The energy required for triggering the formation of the vacancies is extremely high. A reduction of the energy required, which is equivalent to the reduction of the superheat to moderate values, can be affected by various parameters, for example forces of interaction between the liquid and solid interface, which can be influenced by the material of the solid surface and alloying additions to the liquid. For investigating these effects, experiments have been performed with differently prepared surfaces, either mechanically or chemically. The theoretical part is furthermore devoted to the discussion of the mechanism of nucleation in deep wall cavities. (auth)

19647 SOME FACTORS DETERMINING INCIPIENT SUPERHEATS IN ALKALINE METALS. Leonov, A.; Prisnyakov, V.; Voropay, A. (Dnepropetrovsk State Univ., USSR). pp 315-319 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See (CONF-740925-P4.

The results of experimental research of incipient superheats of sodium, potassium, cesium, and sodium-potassium alloys in tubes are given. It has been found that incipient superheat in the previous experiment is determined by the condensation conditions of the steam bubbles. In tests with a stabilized nucleus of the heat-flow the concentration of oxides and a number of other factors do not influence incipient superheating. It has been established that during unstable boiling the superheat in alkaline metals is described by parameters DELTA Ps equals 0.0105 Pcrit. (auth)

19648 HEAT TRANSFER TO SODIUM-POTASSIUM ALLOY IN POOL BOILING. Subbotin, V. I.; Sorokin, D. N.; Kudryavtsev, A. P.; Brigutsa, V. I. (Inst. of Physics and Power Engineering, Obninsk, USSR). pp 325-329 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

Results of an experimental investigation of superheating, heat transfer, and critical heat fluxes for the sodium-potassium alloy of the eutectic composition (78 wt percent K), as well as the dependence of the critical heat flux on the component concentration, are presented. (auth)

19649 INVESTIGATION OF HEAT TRANSFER TO POTASSIUM IN COIL TUBES AND SODIUM-POTASSIUM COIL TUBES GENERATOR. Aladiev, I. T.; Petrov, V. I.; Rzaev, A. I.; Khudiakov, V. F. (Inst. of Power, Moscow). pp 330-334 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

The possibility of developing potassium vapor generators using hot-liquid-heated tubes was investigated by correlating experimental data on potassium flow boiling in electrically heated coiled tubes and data on steam generation in sodium-heated coiled tubes. Information is included on convective heat transfer for heat carrier temperatures from 800 to 1350° K, pressure effects on heat transfer intensity, temperature distribution with boiling in coiled and straight tubes, and critical heat flux. (LCL)

19650 HEAT TRANSFER, 1974. Volume V. Proceedings of the Fifth International Heat Transfer Conference, Held September 3-September 7, 1974, in Tokyo, Japan. Washington, DC; Scripta Book Company (1974). 326p. (CONF-740925-P5).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974).

Sixty-three papers presented at the heat transfer conference are included in this volume. A separate abstract was prepared for one paper. The remaining 62 papers were not within the scope of NSA. (LCL)

For an abstract of an individual paper see: 19651.

19651 NATURAL CONVECTION AND EVAPORATION FROM A FREE SURFACE OF LIQUID SODIUM. Ishiguro, R.; Kumada, T.; Abe, T. (Hokkaido Univ., Sapporo). pp 15-19 of Heat Transfer, 1974. Vol. 5. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P5.

The free surface of the liquid sodium was a narrow rectangle surrounded by a large isothermal plate on the same level, temperature of which is fairly lower than the sodium. Numerical calculations of the convection was performed for the range of Rayleigh number up to 1.6×10^5. The temperature fields were observed by an interferometer. The evaporation rates were measured. The analogy between Nusselt and Sherwood number was valid for a small difference of the temperature between the free surface and the surroundings. Otherwise, sodium fog formed in the cover gas and the Sherwood number became larger. (auth)

19652 HEAT TRANSFER, 1974. Volume VI. Proceedings of the Fifth International Heat Transfer Conference, Held September 3–September 7, 1974, in Tokyo, Japan. Washington, DC; Scripta Book Company (1974). 343p. (CONF-740925–P6).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974).

Forty-six papers presented at the heat transfer conference are included in this volume. A separate abstract was prepared for each of 4 papers. The remaining 42 papers are not within the scope of NSA. (LCL)

For abstracts of individual papers see: 19653–19656.

19653 CALCULATION OF CONVECTIVE HEAT TRANSFER IN COMPLEX FLOW SYSTEMS. Spalding, D. B. (Imperial Coll. of Science and Technology, London). pp 44-60 of Heat Transfer, 1974. Vol. 6. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P6.

Numerical methods of solving the partial differential equations of fluid and heat flow are now capable of predicting the local conductances in heat-transfer equipment and the convective interactions between different parts of the equipment. Examples are cited and applications to the design of cooling towers, steam condensers, furnaces, and nuclear reactors are discussed. (auth)

19654 BOILING 5: TWO PHASE FLOW. Hewitt, G. F. (Atomic Energy Research Establishment, Harwell, Eng.). pp 271-283 of Heat Transfer, 1974. Vol. 6. Washington, DC: Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P6.

The following subjects related to two-phase flow are discussed: mean parameters which describe the general nature of the flow system, such as flow patterns, film flow, and parameters of interest in system design, e.g., pressure drop, void fraction, and heat transfer; fluctuating quantities such as void fraction, temperature, and flow rate, and the transient response of two-phase systems to step changes in input parameters; and flow instabilities including pressure drop and density wave instabilities and the feedback effects from control systems. (auth)

19655 BOILING 6: CRISIS. Nevstrueva, E. (Inst. for High Temperatures, Moscow). pp 284-292 of Heat Transfer, 1974. Vol. 6. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P6.

Information in 13 papers on boiling heat transfer, and specifically boiling crisis, is reviewed. The mechanism of boiling crisis, improved techniques for calculating critical heat fluxes and other parameters which affect the onset of the heat transfer crisis, and experimental methods for investigating the boiling crisis mechanisms are discussed. These studies are particularly significant in the design of large-scale steam generators for conventional and nuclear power plants. (LCL)

19656 BOILING 7: LIQUID METALS, SUPERCRITICAL STATE, BINARY SYSTEMS. Collier, J. G. (United Kingdom Atomic Energy Authority, Harwell, Eng.). pp 293-304 of Heat Transfer, 1974. Vol. 6. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P6.

The following topics are discussed: nucleation theory; experimental studies of incipient boiling superheat for sodium; forced convection boiling of potassium in coils; heat transfer to supercritical steam; and heat transfer to binary systems. (LCL)

19657 HEAT TRANSFER, 1974. Volume VII. Proceedings of the Fifth International Heat Transfer Conference, Held September 3–September 7, 1974, in Tokyo, Japan. Washington, DC; Scripta Book Company (1974). 214p. (CONF-740925–P7).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974).

Forty-seven reports or discussions presented at the heat transfer conference are included in this volume. A separate abstract was prepared for each of 3 presentations. The remaining 44 items were not within the scope of NSA. (LCL)

For abstracts of individual papers see: 19658–19660.

19658 MODELING OF TWO PHASE FLOW. Gidaspow, D. (Inst. of Gas Technology, Chicago). pp 163-168 of Heat Transfer, 1974. Vol. 7. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P7.

Problems related to the mathematical modeling of two-phase flow are discussed, and the opinions of several researchers are given on the present state of development of the continuity, momentum and energy equations for the separate phases and for the mixture; problems due to imaginary characteristics for one-dimensional, transient flow; and the direction that future research should take in this field. (LCL)

19659 TRANSIENT TWO-PHASE FLOW. Hsu, Y. Y. (Atomic Energy Commission, Washington, DC). pp 169-176 of Heat Transfer, 1974. Vol. 7. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P7.

The following papers related to two-phase flow are summarized: current assumptions made in two-phase flow modeling; two-phase unsteady blowdown from pipes, flow pattern in Laval nozzle and two-phase flow dynamics; dependence of radial heat and momentum diffusion; transient behavior of the liquid film around the expanding gas slug in a vertical tube; flooding phenomena in BWR fuel bundles; and transient effects in bubble two-phase flow. (LCL)

19660 LIQUID METALS HEAT TRANSFER. Bankoff, S. G. (Northwestern Univ., Evanston, IL); Aoki, S. pp 192-197 of Heat Transfer, 1974. Vol. 7. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P7.

Five presentations on liquid metal boiling and heat transfer are summarized. Information is included on the uses of boiling liquid metals in industrial processes; sodium technology research in Japan· molecular direct correlation function and thermal conductivity in liquid metals; and acoustic noise associated with forced-convection sodium boiling. (LCL)

19661 THEORY OF NATURAL FREQUENCIES OF TWO PULSATING BUBBLES IN INFINITE LIQUID. Morioka, M. (Tokyo Univ. (Japan). Faculty of Engineering). J. Nucl. Sci. Technol. (Tokyo); 11: No. 12, 554-560(Dec 1974).

The volume oscillation of bubbles is a fundamental problem associated with the behavior of coolant in nuclear reactors and with reactor safety. Many studies have been reported on the oscillation frequency of a single bubble. Based on the theory governing the behavior of a single bubble, an accurate theory is derived on the natural frequencies of two pulsating spherical bubbles placed in an infinite liquid. The problem is reduced to calculation of the effect of a bubble on the inertial constant of the other bubble. Bispherical coordinates are introduced to calculate the velocity potential. The effects of liquid compressibility and viscosity on the natural frequency are shown to be negligible. The most prominent result is that two kinds of frequencies are found to exist when two bubbles oscillate in phase and 180° out of phase. Examination further reveals that the analysis presented includes Shima's solution as a special case. Numerical calculations substantiate the prediction that the resonant frequency of many bubbles is smaller than that of a single bubble. (auth)

Materials Testing

Refer also to abstracts 19679 and 19782.

19662 (DEU-75-4) DETECTION OF SUBPLATING CRACKS WITH THE HELP OF ACOUSTIC EMISSION TESTING. Jax, P. (Battelle-Institut e.V., Frankfurt am Main (F.R. Germany); Zentralstelle fuer Atomkernenergie-Dokumentation, Leopoldshafen (F.R. Germany)). Apr 1973. 31p. (In German). INIS.

12 figs.; 3 tabs.; 52 refs.

Laboratory studies with stress relief annealing of plated reactor steel $^{22}NiMo^{37}Cr$ showed that the acoustic emission analysis is suited as a nondestructive testing method for the detection of under clad cracking. The extent of crack formation can be described with an acoustic emission parameter, i.e., the pulse rate summed up during the glow time. The method allows a coarse classification of cracks with respect to their magnitude and frequency. The utilization of acoustic emission analysis for quality control seems to be useful, to exclude under cladding cracks above a certain magnitude. (GE)

19663 (RD/B/N-3273) MODEL FOR PREDICTING THE REFLECTION OF ULTRASONIC PULSES FROM A BODY OF KNOWN SHAPE. Johnson, D. M. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Mar 1975. 26p. Dep. NTIS (US Sales Only) $4.50.

The reflection of broad-band ultrasonic pulses from an object can result in modifications to both the frequency spectrum and phase information in the pulse. The changes are largely controlled by the shape and nature of the surface of the object. This has been the subject of many recent experimental investigations from which it is apparent that there is a need for a simple, unifying,

theoretical model to account for the observations. Three approximate methods for determining the scattered field have been reviewed, one of which has been developed in a general form and should have considerable applications. From the known shape of the object surface, the response function can be evaluated numerically, and the effect on the incident pulse predicted. (auth)

19664 NONDESTRUCTIVE TESTING AND HYDROELECTRIC APPLICATION WITH SPECIFIC DISCUSSION OF ULTRASONIC AND RADIOGRAPHIC INSPECTION STANDARDS. Haynes, C. B. (Hydro-Electric Commission of Tasmania, Australia). Test., Instrum. Controls.; 12: No. 1-2, 17-25 (1975).

From 4th national conference of AINDT; Melbourne, Australia (Aug 1974).

The paper discusses NDT as used in the Hydro-Electric Commission, Tasmania. The paper concerns itself with applications and procedures. Emphasis is placed on examination to the AS 1210 acceptance standard of heavy section welded components for the Stage 1 scheme of Gordon River Power Development. (auth)

19665 NEUTRON RADIOGRAPHY WITH A 1 MeV VAN DE GRAAFF GENERATOR. Hiraoka, E.; Fujishiro, M.; Tsujii, Y.; Furuta, J. Annu. Rep. Radiat. Center Osaka Prefect.; 15: 61-65(1974).

Neutron radiography using a 1-MeV Van de Graaff accelerator to produce 14-MeV neutrons from D–T reactions is reported. A comparison of γ-ray and neutron radiographs of several objects is shown. (TFD)

19666 OPTIMUM LINEAR FILTRATION IN PROCESSING DISCRETE RADIOMETRIC INFORMATION. Pokrovskii, A. V.; Selivanov, V. G. (Scientific-Research Inst. of Electron Radiography, Tomsk, USSR). Sov. J. Nondestr. Test.; 10: No. 5, 555-562(1974).

Translated from Defektoskopiya; 10: No. 5, 67-74(1974).

A linear filter is proposed for processing discrete radiometric information in detecting random-amplitude signals from defects. It is assumed that the signal amplitude distribution is known. It is shown that this filter is the optimum one in the class of linear systems. (auth)

19667 AUTOMATIC CARRIAGE FOR RADIOGRAPHING WELDINGS FROM THE INSIDE OF PIPELINES BY MEANS OF X-RAYS AND RELEVANT DEVICES. Gambini, A.; Capitelli, G. (to Snam-Progetti SpA). US Patent 3,889,116. 10 Jun 1975. Priority date 17 Feb 1972, Italy. 10p.

A tandem radiography vehicle for use in pipelines includes a carriage assembly, having an internal combustion engine and a dynamo-alternator motor for driving the vehicle, and powering an x-ray tube. Electronic circuitry for controlling the operation and power to the x-ray tube are included. A compass control system on the carriage is activated by a magnet externally positioned on the pipeline for positioning the vehicle at a weld inspection area. Means for segregating exhaust from the engine are also disclosed. (auth)

19668 ELEMENTS AND PROCESS FOR RECORDING DIRECT IMAGE NEUTRON RADIOGRAPHS. Poignant, R. V. Jr.; Przybylowicz, E. P. (to Eastman Kodak Co.). US Patent 3,887,807. 3 Jun 1975. Filed date 20 Jul 1973. 14p.

An element is provided for recording a direct image neutron radiograph, thus eliminating the need for a transfer step (i.e., the use of a transfer screen). The element is capable of holding an electrostatic charge and comprises a first layer for absorbing neutrons and generating a current by dissipation of said electrostatic charge in proportion to the number of neutrons absorbed, and a second layer for conducting the current generated by the absorbed neutrons, said neutron absorbing layer comprising an insulative layer comprising neutron absorbing agents in a concentration of at least 10^{17} atoms per cm^3. An element for enhancing the effect of the neutron beam by utilizing the secondary emanations of neutron absorbing materials is also disclosed along with a process for using the device. (auth)

19669 RADIOGRAPHIC TEST ON WELDED JOINTS OF 9% Ni STEEL. Conversion of Penetrameter Sensitivity and Adjustment of Photographic Density. Senda, T.; Hirayama, K. (Osaka Univ., Suita (Japan). Faculty of Engineering); Terada, Y.; Tsutsumi, M. Hitachi Zosen Giho; 35: No. 2, 76-81(Jun 1974). (In Japanese).

High-nickel-alloy electrodes are usually used for the welded joints of 9% Ni steel. And the absorption of x-rays in the joints depends on the chemical composition of weld metals. The weld metal in the joints of 9% Ni steel brings two problems into its radiography: difficulties in obtaining the image quality of the radiograph and in obtaining photographic density within an allowable range. The absorption of x-rays in the joints was studied and a practical method to overcome the problems was developed. The method is based on the following: (1) carbon-steel-penetrameters are applicable to welded joints of 9% Ni steel, provided a simple dimensional conversion is executed; and (2) a "Masking Plate" developed in this study is effective in adjusting the absorption of x-rays; otherwise, the difference of photographic density would be unavoidable between the weld metal and the parent metal. (auth)

19670 A STUDY ON THE APPLICATION OF X-RAY DIFFRACTION TECHNIQUE TO FAILURE ANALYSIS OF METAL COMPONENTS. Goto, T. (Mitsubishi Heavy Industries Ltd., Kobe (Japan). Kobe Technical Inst.). pp 265-278 of Mechanical Behavior of Materials. Proceedings of the 1973 Symposium. Kyoto, Japan; Society of Materials Science (1974).

From 1973 symposium on mechanical behavior of materials; Kyoto, Japan (21 Aug 1973).

Intending to apply the x-ray diffraction technique to failure analysis of metal components, x-ray observations of deformed specimens and fracture surfaces of a normalized 0.36% carbon steel were conducted. The estimation of the amount of deformation, the identification of the fracturing process, and fatigue fracture analysis were attempted. From this investigation, it was recognized that the x-ray diffraction technique is a useful tool for the failure analysis of metal components, and the distinguishing traits of this method are discussed. (auth)

19671 WET ENVIRONMENT RADIOGRAPHY APPARATUS. English, P. N. US Patent 3,891,845. 24 Jun 1975. Filed date 18 Dec 1972. 8p.

A radiography apparatus attachable to the exterior surface of an object which is to be radiographed where the exterior surface is underwater is described. (auth)

19672 ACOUSTIC EMISSION MONITORING DURING HYDROTESTS OF A THIN WALL PRESSURE VESSEL. Fontana, E.; Grugni, G.; Panzani, C.; Pirovano, B.; Possa, G.; Tonolini, F. (CISE, Milan). Energ. Nucl. (Milan); 22: No. 5, 253-259(May 1975).

From 3rd meeting of the European Working Group on acoustic emission; Ispra, Italy (25 Sep 1974).

Results are presented of an acoustic emission monitoring performed during hydrotests of a thin wall steel pressure vessel. The location of acoustic sources was based on longitudinal wave front detection. The careful calibration of the three sensors instrumentation system used for acoustic source location was found to be very useful, and allowed an accurate location error analysis. Acoustic emission in the hydrotests was found to be mainly due to stress release in weld seams. (auth)

Nuclear Explosions

Refer also to abstracts 19713, 19770, 19837, and 20771.

19673 (NVO-155(Vol.2)) IN SITU LEACHING OF A NUCLEAR RUBBLIZED COPPER ORE BODY. Volume II. (USAEC Nevada Operations Office, Las Vegas; Kennecott Copper Corp., Lexington, Mass. (USA). Ledgemont Lab.; California Univ., Livermore (USA). Lawrence Livermore Lab.). Jun 1975. Contract AT(26-1)-585. 333p. Dep. NTIS $19.75.

This volume contains detailed descriptions of technical and economical evaluations undertaken for the feasibility study. A summary of these results can be found in Vol. 1 along with the conclusions derived from the feasibility study and the recommendations tendered for future work. The sections of this study are presented in process order, and each section is complete in itself. The form of the presentation, hopefully, is logical and in a manner suitable for design purposes. As a further aid, each section has its own table of contents. The sections presented include method of attack, reference case, description of concept, nuclear rubblization, blasting plan, underground plumbing, fluid circulation, leaching technology, wellhead plant and pipeline, process plant, material and heat balance, hydrology, radioactivity, seismic, economics, sensitivity analysis, guide for environmental studies, exploration, and recommended experimental program. (TFD)

19674 (UCRL-51834) HYBLA FAIR EVENT: ENVIRONMENTAL REPORT. Roach, D. R.; Russell, W. L. Jr. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 30 May 1975. Contract W-7405-Eng-48. 14p. Dep. NTIS $4.00.

A series of environmental measurements during the Hybla Fair nuclear event were made. Experimenters were unsure of conditions that would be created since there was no closure system and the experiments were close to the source. A variety of tempera-

ture, pressure, and load devices were tested. The results will aid in the design and engineering of future close-in diagnostic packages and pipes. (auth)

19675 INFLUENCE OF CONSTITUTIVE MODELS ON GROUND MOTION PREDICTIONS. Baron, M. L.; Nelson, L; Sandler, I. J. Eng. Mech. Div., Am. Soc. Civ. Eng.; 99: 1181-1200(Dec 1973).

In recent years, the development of mathematical models for the study of ground shock effects in soil, or rock media, or both, has made important progress. Three basic types of advanced models have been studied: (1) elastic ideally plastic models, (2) variable moduli models and (3) elastic nonideally plastic capped models. The ground shock response in the superseismic range of a 1-MT air burst on a homogeneous halfspace of a soil is considered. Each of the three types of models was fitted to laboratory test data and calculations were made for each case. The results from all three models are comparable only when the stress paths in uniaxial strain are comparable for complete load-unload cycles. Otherwise, major differences occur in the lateral motions and stresses. Consequently, material property laboratory data now include the stress path whenever possible for modeling purposes. (TSS)

19676 JAPAN'S NUCLEAR OPTION: POLITICAL, TECHNICAL, AND STRATEGIC FACTORS. Endicott, J. E. Praeger Special Studies in International Politics and Government. New York; Praeger Publishers, Inc. (1975). 308p. $20.00.

The possibility of Japan arming itself with nuclear weapons is examined by considering the domestic and international political environment in 1974, the status of nuclear industry development, capabilities of delivery systems, and predicted nuclear options for 1985. (LCL)

Protective Structures and Equipment

19677 (AED-CONF-73-697-000, pp 25-42) FINDINGS OF IMPACT SHOCK ON CONSTRUCTIONAL ELEMENTS IN SIMULATION PLANTS. Weigel, G. 1973. (In German).

From meeting of the Schutzkommission by the Bundesministerium des Innern; Goettingen, F.R. Germany (Jun 1973).

19 figs.

In Schutzkommission by the Bundesministerium des Innern. Papers presented at the meeting at Goettingen. (Bundesministerium des Innern, Bonn (F.R. Germany). Abt. Reaktorsicherheit und Strahlenschutz).

In nuclear explosions, about 50% of the total energy is released as mechanical energy, most of it—in above-ground explosions—in an air shock wave. The pressure of the shock wave on a shelter or its parts is two-dimensional, with a steep rise to peak pressure and a slow drop that can be measured in seconds. Experiments in large simulation facilities are to test the reactions of a shelter or its parts to this pressure. The results are evaluated with regard to the incorporation of new knowledge into the present regulations for the design of shelters. (GE)

19678 (ANL/HFEF-006) PLUTONIUM CONTAMINATION MONITORING IN THE HFEF HOT CELLS DURING SECTIONING OF MARK-IIA SODIUM LOOPS. Cook, J. H.; Villarreal, R.; Holson, C. E.; Kerr, J. F. (Argonne National Lab., Idaho Fall, Idaho (USA)). May 1975. Contract W-31-109-Eng-38. 48p. Dep. NTIS $5.50.

An extensive program for monitoring alpha contamination was conducted in-cell and out-of-cell in HFEF/S to establish the contamination spread from sectioning sodium loops that contained failed mixed-oxide fuel elements. The monitoring program was maintained during the sectioning of six RAS-TREAT Mark-IIA loops in the argon cell. The monitoring program provided conclusive evidence that no contamination spread resulted from sectioning the loops. (auth)

19679 MATERIAL MONITORING FACILITY AND TEST EXPERIENCES. Suzuki, K. (Power Reactor and Nuclear Fuel Development Corp., Oarai, Ibaraki (Japan). Oarai Engineering Center). Doryokuro Giho; No. 11, 52-66(Jul 1974). (In Japanese).

Material Monitoring Facility (MMF) was constructed in PNC's Oarai Engineering Center to study the behavior of materials after irradiation for fast reactor development. The materials tested after irradiation with this facility are largely for fuel assembly, reactor structure, control rod, and shield. For the purpose, a variety of test apparatuses are provided; and the adequacy of their usage leads to the success of post-irradiation tests. Reviewing the experiences in the past two years after its completion, the following matters are described: outline of the facility, procedure of the post-irradiation tests, and the present state of tests carried out with the MMF. (JA)

Safety Engineering

Refer also to abstract 19410.

19680 (LMEC-TDR-75-9) FAILURE ANALYSIS OF BELLOWS ON SCTI PRIMARY PLUGGING METER VALVE HIC-517V. Thompson, E. G. (Liquid Metal Engineering Center, Canoga Park, Calif. (USA)). 15 Jul 1975. Contract AT(04-3)-700. 29p. AT.

During operation of the PM-1 plugging meter, a small sodium leak was observed in the bellows region of the HIC-517V primary plugging meter valve, indicating the bellows seal had failed. The bellows was removed from valve HIC-517V, cleaned, and subjected to failure analysis which employed visual, leak testing, metallographic, and SEM techniques. Failure occurred by cyclic fatigue. (auth)

Vacuum Engineering

19681 BAKEABLE GLASS ISOLATION VALVE FOR UHV SYSTEMS. Sharma, J. K. N.; Sharma, D. C. (National Physical Lab., New Delhi). Rev. Sci. Instrum.; 46: No. 7, 932-933(Jul 1975).

A bakeable (up to 450°C) isolation valve made of glass using a standard ground ball and socket joint is described. The valve is useful for most glass UHV systems, e.g., field-ion microscopes or gauge calibration. (auth)

ENVIRONMENTAL AND EARTH SCIENCES

19682 (CONF-730417-, pp 21-24) DEPARTMENT OF DEFENSE RESEARCH AND DEVELOPMENT IN HAZARDOUS MATERIAL DISPOSAL. Dashiell, T. R. Sep 1973.

From 4th annual environmental pollution symposium of the American Ordnance Association; Edgewood Arsenal, Maryland, USA (4 Apr 1973).

In proceedings of fourth annual symposium on environmental pollution. (Edgewood Arsenal, Md. (USA)).

Many materials handled within DoD activities can be considered hazardous. These include explosives, propellants, some industrial chemicals and industrial wastes, and radioactive materials. To address these and other environmental quality research and development programs, the Director of Defense Research and Engineering (DDR and E) is preparing an Area Coordinating Paper (ACP). The ACP is an internal management device to assess the needs to meet system requirements, determine technology deficiencies by comparison of needs with current research and development programs, develop new research and development programs to meet needs, and provide general guidance to the military departments. The ACP for research and development in environmental quality develops these areas for six mission-oriented areas which encompass DoD activities. (auth)

19683 (CONF-730417-, pp 25-59) NAVAL ORDNANCE RDTE PROGRAM ON POLLUTION ABATEMENT. Quagliarello, D. J.; Amster, A. B. Sep 1973.

From 4th annual environmental pollution symposium of the American Ordnance Association; Edgewood Arsenal, Maryland, USA (4 Apr 1973).

In proceedings of fourth annual symposium on environmental pollution. (Edgewood Arsenal, Md. (USA)).

This is a presentation of the Navy's RDTE program in the field of ordnance pollution abatement. It covers manufacturing, reclamation, and disposal of propellants, explosives, and pyrotechnics (PEP). The figures will show the operating conditions before the program began, the extent of the problem, and the processes and equipment used and under development for pollution abatement. (auth)

19684 (CONF-730417-, pp 111-114) NATIONAL DISPOSAL SITES FOR HAZARDOUS WASTES. Morekas, S. (Environmental Protection Agency, Washington, DC). Sep 1973.

From 4th annual environmental pollution symposium of the American Ordnance Association; Edgewood Arsenal, Maryland, USA (4 Apr 1973).

In proceedings of fourth annual symposium on environmental pollution. (Edgewood Arsenal, Md. (USA)).

The Resource Recovery Act of 1970 calls for a plan for creating a system of National Disposal Sites for the storage and disposal of hazardous wastes, including radioactive, toxic-chemical, biological, and other wastes which may endanger public health or welfare. The Environmental Protection Agency (EPA) is completing its report on the development of a disposal plan; the report is scheduled for submission to the Congress in June 1973. This presentation briefly describes the types of input from five contract studies used to assist the EPA in its national disposal sites study. The contract work covered these aspects: hazardous waste disposal survey, study of current and recommended hazardous waste management methods, research on public attitudes toward disposal of hazardous wastes, alternatives to a system of national disposal sites, and a feasibility study for development of a system of hazardous waste national disposal sites. The technical assistance of the U.S. Geological Survey is also cited and certain definitions of the EPA role, contained in proposed legislation, are outlined. (auth)

19685 (CONF-730417-, pp 119-127) NUCLEAR WASTE DISPOSAL. Burch, W. D. (Oak Ridge National Lab., TN). Sep 1973.

From 4th annual environmental pollution symposium of the American Ordnance Association; Edgewood Arsenal, Maryland, USA (4 Apr 1973).

In proceedings of fourth annual symposium on environmental pollution. (Edgewood Arsenal, Md. (USA)).

A key problem on the road to a thriving nuclear power industry is the development of acceptable disposal methods for the fission product and other wastes from reactor fuel reprocessing plants. The Atomic Energy Commission (AEC) is involved in a major research program which is designed to find technical solutions to these problems. A slow and rather deliberate approach is being followed in order to gain public confidence and acceptance of the scheme finally chosen. Decisions have already been made to provide a Federal repository in which all these wastes must be disposed. The most promising long-term solution seems to be disposal in salt formations 1000 feet or more underground. A test of this method in a Kansas salt mine was successful, but some technical questions about unknown, abandoned wells drilled through the site and the solution mining operation in an adjacent site led to public and political opposition and a decision to seek a more isolated location. In the meantime, the AEC has decided to provide surface engineered storage facilities for interim storage of these wastes for the next 10 to 30 years. Whenever a geologic system which requires no continuous surveillance has been developed and fully accepted, the engineered storage would be phased out. Major efforts are also being devoted to finding disposal methods for the 90 million gallons of high-level wastes stored in underground tanks from the plutonium production programs. On-site schemes are being sought for purposes of economy, but shipment to the Federal repository may be required if no acceptable on-site method is found. (auth)

19686 (CONF-730417-, pp 129-138) USE OF SALT REPOSITORIES FOR LONG-TERM RETENTION OF HAZARDOUS WASTE MATERIAL. Brandt, C. T. (Fenix and Scisson, Inc., Tulsa, OK). Sep 1973.

From 4th annual environmental pollution symposium of the American Ordnance Association; Edgewood Arsenal, Maryland, USA (4 Apr 1973).

In proceedings of fourth annual symposium on environmental pollution. (Edgewood Arsenal, Md. (USA)).

In 1955, the National Research Council considered the possibilities for long-term retention of hazardous wastes such as high-level radioactive material in geologic structures. These deliberations led to the conclusion that storage in chambers created in naturally existing salt formations offered the most promise. In the intervening years, much additional information has been developed which completely supports the original basic conclusion. Yet, in spite of the confirmations, the proposal appears to remain generally objectionable and is not being used. The question is, "Why." This paper will review the factors leading to the original conclusions and recommendations. It will identify some of the pertinent additional confirmatory work done to support the original premise. It will review the origin, downfall, and subsequent effect of the ill-fated Lyons, Kansas, project. It will draw conclusions as to why that project met with its demise. And finally, it will point out some of the things that must be done if salt is to be used effectively in the future for the long-term retention of hazardous waste material. (auth)

19687 (CONF-750642-1) SURVEY OF FISHES FROM BARRIO ISLOTE ON THE NORTH COAST OF PUERTO RICO. Kimmel, J. J. (Puerto Rico Nuclear Center, Mayaguez). 1975. 38p. Dep. NTIS $5.00.

From American Society of Ichthyologists and Herpetologists; Williamsburg, Virginia, USA (8 Jun 1975).

Tables are presented to show ichthyofauna associated with each habitat. From this data it is clear that the most abundant fishes in all habitats belong to the family Labridae. These small fishes are extremely important to the total ecosystem in several ways. As juveniles, many of them perform as cleaners in a symbiotic relationship with larger fishes and as adults they represent a major food item for the piscivorous fishes in the area. Zooplanktologists report large numbers of fish eggs (approx. $100/m^3$) occurring in samples from Islote. Probably large numbers of eggs are transported to the area by east-west trending currents present along the north coast. Migration in fishes is hard to assess without a tagging and recapturing program but casual observations indicate that few, if any, species migrate regularly to or from the Islote area. Seasonality occurs in that during the winter months the fishes stray less from their normal cover and consequently they show up less in both collections and visual census operations. The Islote area has virtually no commercial or sport fishing pressure applied to it because most of the commercially important and sport fishes inhabit waters further offshore. (auth)

19688 (ORO-4254-30) MINERAL CYCLING IN RESERVOIRS. Toetz, D. W. (Oklahoma State Univ., Stillwater (USA)). 1974. 21p. (CONF-741167-1). Dep. NTIS $4.25.

From reservoir resources symposium; Durant, Oklahoma, USA (Nov 1974).

A review of literature on nitrogen cycling in reservoirs is presented. Some topics discussed are: input of N through influents, as precipitation or a gas through the surface, as ground water, and through biological nitrogen fixation; N losses; and the role of biota in trapping N compounds. (HLW)

Minerals and Ores

Refer also to abstracts 19716, 19723, 19730, 19755, 19809, and 19810.

19689 (CONF-720805-P1, pp 155-180) QUANTITATIVE INTERPRETATION OF THE GAMMA-RAY SPECTRA FROM GEOLOGIC FORMATIONS. Loevborg, L. (Research Establishment, Risoe, Denmark); Kirkegaard, P.; Rose-Hansen, J. 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Experience with the use of gamma-spectrometry for field determination of thorium, uranium, and potassium has shown that sampling of geologic formations by direct gamma-spectrometric analysis of rock outcrops and beach sand deposits is more efficient than collecting material for later radioelement analysis in the laboratory. A portable gamma-spectrometer is quick to use and provides a direct means of selecting optimum sample patterns and a single field determination of the natural radioelements by gamma-spectrometry is representative of a rock mass of as much as several tens of kilograms. The problem of determining the coefficient matrix which characterizes the gamma-spectrometer conversion equations is considered. An accurate evaluation of this matrix is more difficult than in gamma-spectrometric analysis of small samples in the laboratory. However, a field gamma spectrometer is readily calibrated with Th-U-K standards, which are only a few meters in diameter, provided that the directly measured calibration constants are corrected for the finite dimensions of the standards. If the chemical composition of the geologic formations to be sampled by field gamma-spectrometry is very different from the chemical composition of the standards, another set of correction factors must be applied to the calibration constants. To allow for corrections like these, a computer model was developed whose first part permits an accurate calculation of the spectral composition of the gamma flux near the surface of large, but finite, as well as semi-infinite, source media. The second part of the model is used for a simplified calculation of the pulse-height distribution produced by the gamma flux at the output of a crystal photomultiplier assembly. Therefore, besides giving a practical solution to the calibration problem in field gamma-spectrometric rock analysis, a method for the prediction of detailed scintillation spectra from various geologic formations is also presented. (CH)

19690 (CONF-720805-P1, pp 181-231) HIGH-RESOLUTION GAMMA RAY SPECTROMETRY FOR LABORATORY ANALYSIS OF THE URANIUM AND THORIUM DECAY SERIES. Smith, A. R.; Wollenberg, H. A. (Univ. of California, Berkeley). 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Experimental data and results obtained with a Ge(Li) spectrometer system are discussed including studies of the uranium series and the thorium series, with emphasis on spectral evidence for disequilibrium conditions. A study of the problem of U-content of the Th-standard provided by the USAEC New Brunswick Laboratory (NBL) is described and an obvious solution is presented. Examples of U and Th analyses of relatively high activity materials, including comparisons with NaI(Tl) spectrometric determinations are included. The reasonable lower limits of U and Th concentrations that can be successfully measured with such a system and the necessity for digital computer processing of this type data in order to extract all the information required for the analysis procedures described are discussed. Data on the decay series of ^{238}U, ^{235}U, and ^{232}Th are included and recent data on the energies and intensities of some gamma-transitions are also included. (CH)

19691 (CONF-720805-P2, pp 457-481) GEOLOGICAL FACTORS CONTROLLING TERRESTRIAL GAMMA-RAY DOSE RATES. Wollenberg, H. A.; Smith, A. R. (Univ. of California, Berkeley). 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

The natural component of environmental gamma radioactivity measured on land depends mainly on the uranium, thorium, and potassium contents of the rock and soil. The distribution and abundance of these radioelements in turn depend on whole-rock chemistry, which, in many cases, may be related to global tectonic features. Western North America, presently undergoing active tectonism, contains a wide variety of rock types. Data are presented on rocks of California and western Nevada that cover a broad range in lithology, from ultramafic to granitic plutonic igneous rocks and from carbonate to siliceous clastic sedimentary rocks. The exposure rate histograms of the rock types containing appreciable radioactivity are shown. Within these categories, natural radioelement contents and associated gamma-ray exposure rates also vary over broad ranges; for example, in plutonic rocks over an order of magnitude between low-radioactivity diorites and gabbros and more radioactive quartz monzonites and granites. It has also been observed that volcanic rocks vary in radioactivity similar to their plutonic counterparts. (auth)

19692 (CONF-720805-P2, pp 483-515) REVIEW OF U AND Th DISTRIBUTIONS IN RECENT VOLCANICS FROM SOUTHERN ITALY: MAGMATOLOGICAL AND GEOPHYSICAL IMPLICATIONS. Civetta, L. (Univ., Napoli, Italy); Gasparini, P. 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Data are summarized on the uranium and thorium concentrations of the Italian volcanic rocks. The petrogenetic and geophysical implications of uranium and thorium distributions in these rocks are discussed. (CH)

19693 (CONF-720805-P2, pp 517-533) URANIUM, THORIUM, AND POTASSIUM CONTENTS OF JAPANESE GRANITIC ROCKS: A SUMMARY UP TO 1972. Kanaya, H., Ishihara, S. (Geological Survey of Japan, Hisamoto). 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Determination of the uranium and thorium contents of granitic rocks in the Japanese Islands has been systematically carried out since 1965. The earlier work was published in the Report 232 of the Geological Survey of Japan (Hayase et al., 1969; Hida et al., 1969; Ishihara and Suzuki, 1969; Ishihara et al., 1969; Kanaya, 1969). The wide scope of the determinations was based on the fact that the bedded-type uranium deposits in Japan are considered to be derived from basement granitic rocks. Even such a small difference as 4 vs. 2 ppM in the uranium content seems important in the formation of the uranium deposits. The presence of the high uranium-content granitic rocks and an euxinic environment in the overlying sediments are significant clues in exploration. Determinations were also aimed at finding any granitic mass having a high content of uranium and thorium, which may prove to be a future resource of these elements. (CH)

19694 (CONF-720805-P2, pp 535-558) URANIUM, THORIUM, AND POTASSIUM CONTENTS IN GRANITIC AND BASALTIC ROCKS IN JAPAN. Miyake, Y. (Japan Science Council, Tokyo); Sugimura, Y.; Hirao, Y. 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Data are presented on the concentration of uranium, thorium, and potassium in rocks in the continental area of Japan. Average concentrations in the crust are, respectively, 2.7 ppM, 9.6 ppM, and 2.09 percent for uranium, thorium, and potassium. (CH)

19695 (CONF-720805-P2, pp 667-679) GAMMA RADIATION, AN AID TO GEOLOGIC MAPPING ON THE ARABIAN SHIELD, KINGDOM OF SAUDI ARABIA. Flanigan, V. J. (Geological Survey, New York, NY). 1972.

From second conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Aerial gamma-radiation measurements in the Jabal Al Qarah quadrangle, Saudi Arabia, correlate with and complement magnetic data in distinguishing common Precambrian rock types. Areas of lower total-count gamma radiation correlate with areas of more intense magnetic patterns, which in turn correlate with areas of mafic rocks, as suggested from the study of the geophysical and geologic data of the Jabal Ishmas and Jabal Yafikh quadrangles adjacent to the north. In contrast, areas that reflect a lower magnetic intensity tend to show considerable variation in the radiation intensity and can be interpreted as being underlain by granitic rocks. On the basis of extrapolation of geophysical-geologic relationships established previously, selected radiation levels may be used to identify mappable rock units. Thus, radioactivity levels of 2,000 to 4,000 cpM suggest mafic rocks, levels of 4,000 to 6,000 cpM represent metavolcanic and metasedimentary rocks, levels of 7,000 to 10,000 cpM are representative of granodiorite gneiss, and levels of more than 11,000 cpM typify granitic rocks. The spectral gamma-radiation data are used to evaluate total-count anomalies and indicators of geologic processes of enrichment, and estimating the amount of isotopes of U, Th, and K within each of the lithologic units. (CH)

19696 (CONF-720805-P2, pp 681-704) AIRBORNE GAMMA-RAY SPECTROMETRIC MEASUREMENTS OVER THE CANADIAN SHIELD. Richardson, K. A.; Darnley, A. G.; Charbonneau, B. W. (Geological Survey of Canada, Ottawa, Ontario). 1972.

From second conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

In 1967 the Geological Survey of Canada initiated a project to develop a high-sensitivity airborne gamma-ray spectrometer for the purpose of measuring surface concentrations of potassium, uranium, and thorium. The airborne spectrometer system has been in operation since the summer of 1969. It has been engaged in four types of work: experiments to establish physical and operational parameters of the system; detailed experimental surveys of areas of known economic uranium occurrence; experimental surveys at wide line spacing for the purpose of aiding geological mapping and evaluating economic potential; and cross-country reconnaissance flights in order to determine large scale regional variations in radioelement distribution within the Canadian Shield. More than 25,000 kilometers (16,000 miles) of cross-country reconnaissance survey lines have been flown over the Canadian Shield in the summers of 1969, 1970, and 1971. Data collected on these cross-country flights are summarized. (CH)

19697 (CONF-720805-P2, pp 731-740) PHYSICAL CHARACTERISTICS OF RADON-222 EMANATION FROM ROCKS, SOILS AND MINERALS: ITS RELATION TO TEMPERATURE AND ALPHA DOSE. Barretto, P.M.C. (Univ. of Sao Paulo, Brazil); Clark, R. B.; Adams, J. A. S. 1972.

From second conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

The results are presented of studies of ^{222}Rn emanation that indicate that radon emanation occurs not only from the porous space of soils and ordinary rocks but there is also a significant diffusion of radon from the production sites within crystal structures to the grain surfaces. Rocks show a wide range of radon loss with values ranging from 1 to 20 percent of the total radon produced under identical laboratory conditions. The granitic rocks are the major contributors per weight unit among common rocks to radon release to the atmosphere whereas basic and calcareous rocks are only minor contributions. The total amount of radon-222 released by sandstones, conglomerates, and granites is larger than all other rock types together. Thus, the best natural shield materials to be used in the preparation of concrete aggregates used in the construction of low level radiation facilities would be limestone, gabbro, and serpentinites which besides their low uranium concentration have a small percentage of radon escape, in general less than 1 percent. Soil emanation is more uniform in range and variations within the same soil type. The average radon loss is 20 to 40 percent. The lowest emanators are the sandy soils. The residual soils show the largest radon activities and as they have a large percentage of radon escape, they are the most important single contributors per weight unit to the atmospheric radon. (auth)

19698 (CONF-720805-P2, pp 863-882) EXTREME ACCUMULATIONS OF NATURAL POLONIUM-210 IN CERTAIN MARINE ORGANISMS. Folsom, T. R.; Wong, K. M.; Hodge, V. F. (Scripps Inst. of Oceanography, San Diego, CA). 1972.

From second conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Concentration levels of polonium-210 reported for seawater are reviewed, and activities accumulated by various marine plant and animal species are discussed. Special mention is made of detailed studies of one giant algae upon whose outer surfaces intense accumulations of polonium have been discovered recently. Some concentrations found in two organisms intimate with algae, the abalones and the sea hares, are reported. Concentrations are listed pertaining to organisms selected from the open ocean in order to show that intense polonium concentrations are not restricted to organisms living near the continents where precursors of polonium originate. A brief discussion of conditions on one of the marine mammals, the dolphin, next is made. Then comments are made upon a benthic species (the sable fish) that prefers to live close to the deep sea floor, presumably so as to eat detritus. They also eat many of the smaller organisms that compete for the natural deep sea fallout of food, and many of these live in close contact with the muds and clays of the sea floor that are rich in radium. Some of the behavior and anatomical features and polonium-210 distribution in one of the most interesting and valuable of fishes, the North Pacific albacore (Thunnus alalunga) is described. This species has been used previously to tell us something about nuclear fallout distributions in the North Pacific Ocean during the past decade and repeatedly has directed attention to features of this ocean that might hardly be detected otherwise. (CH)

19699 (CONF-720805-P2, pp 845-862) ENVIRONMENTAL SURVEILLANCE IN SOUTH TEXAS. Wukasch, M. C.; Cook, L. M. (Texas State Dept. of Health, Austin). 1972.

From second conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Monitoring of surface and groundwater in the uranium producing district of Texas has shown that high concentrations of radium-226 and other alpha emitters exist naturally in ground- and surface waters. Groundwaters taken from producing water wells within 5 miles of the mines usually have alpha activities above 3 pCi/l and one well has been shown to contain radium-226 in excess of the maximum permissible concentration for occupational exposure. Water from municipal supplies is usually low in gross alpha and beta radioactivity. Surface streams in the area are generally low in radioactivity; however, waters in one stream have been found to contain uranium-238 and radium-226 concentrations of 56 and 1.6 pCi/l from natural causes, and 1138 and 90.2 pCi/l of these isotopes due to uranium mining operations. (auth)

19700 (LA-UR-75-1127) U. S. STUDIES OF THE OKLO PHENOMENON. Cowan, G. A.; Bryant, E. A.; Daniels, W. R.; Maeck, W. J. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-ENG-36. 22p. (CONF-750641-2). Dep. NTIS $4.25.

From IAEA international symposium on the Oklo phenomenon; Libreville, Gabon (23 Jun 1975).

Analyses of samples from the Oklo site are in agreement with previous reports by Naudet et al concerning the occurrence of a natural chain reaction in Precambrian times. A preliminary modeling of the reactor suggests that the event took place 1.7 to 1.9 b.y. ago, and that the period of criticality lasted at least 2×10^5 years. Uranium may have accreted and, to a lesser extent, migrated during the period of criticality or subsequent to it. (auth)

19701 THE URANIUM MINING AND ITS IMPORTANCE FOR THE ENERGY SUPPLY. Maget, P. Glueckauf.; 111: No. 6, 281-292(Apr 1975). (In German).

12 figs.; 4 tabs.

A brief discussion of the importance of uranium in energy production is followed by a survey of the different kinds of uranium ore deposits. Some basic aspects of uranium ore mining are described with regard to the different deposits. Finally, some comments are made on current problems of the uranium market, uranium processing and energy policy. The main point of interest is the French uranium supply. (GE)

19702 SUPPLIES FOR THE FUEL CYCLE FOR SPANISH NUCLEAR POWER PLANTS. Isla Sanchez, M. Energ. Nucl. (Madrid); 18: No. 91, 304-308(1974). (In Spanish).

The diversifed approach to assuring an adequate U supply for the Spanish reactors now under construction or planned is described. This includes exploitation of known Spanish reserves, processing of the concentrates in Spanish installations, foreign contracts to supply the deficit, and an extensive exploration program to discover new U deposits. A contract has been signed with the AEC to provide the necessary until a multinational enrichment plant begins operations in 1978-79. (JSR)

19703 URANIUM CONTENT IN NATURAL WATER. Doi, K.; Aoyama, Y. (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)). Kozan Chishitsu; No. 5, 35-45(1973). (In Japanese).

Special issue of "Kozan Chishitsu".

This report summarizes reconnaissance studies of the geochemical prospecting of U by natural water in the areas of Japan and overseas countries. The Power Reactor and Nuclear Fuel Development Corporation of Japan has been doing this prospecting since 1958. Each U content of water taken from eight geological terrains, hot springs, mineral springs, and rivers of the main island of Japan, central part of British Columbia, Canada and four geological terrains of Australia has been determined. The U contents of 14,764 water samples taken from main island of Japan are ranged from 0.00 to 68.5 part per billion (ppb) uranium, 68 water samples from British Columbia are ranged from 0.01 to 24.0 ppb and 246 water samples from Australia are ranged from 0.00 to 95.0 ppb. The content of U in natural water is so variable depending on chemical and physical factors of water that many determinations of the uranium content are necessary to set up the correct background and to evaluate the terrain. (auth)

19704 CHANGE OF URANIUM CONCENTRATION IN PLAGIOCLASE OF VARIOUS ZONES OF MICROCLINE–ALBITE–OLIGOCLASE PEGMATITES OF KARELIA. Kravchenko, S. M.;

Kalita, A. P.; Flerova, L. B.; Rabinovich, B. S. (Inst. of Mineralogy, Geochimistry, and Crystallography of Rare Elements, Moscow). Geokhimiya; No. 2, 291-295(Feb 1975). (In Russian).

Uranium was determined in 17 plagioclase samples from different pegmatite zones, using fission-radiography in which ^{235}U fragments formed by thermal neutron (reactor) irradiation create defects in a lawsonite detector. The data obtained indicate that in the process of pegmatite crystallization the uranium is fractionated between plagioclase and pegmatite melts with a constant distribution coefficient (calculated to be 0.533). U concentration deviations from the average in the plagioclase may be due to the effect of superposition of processes and to crystallization of accessory minerals which concentrate the U. (TTT)

Radioactive Effluents

Refer also to abstracts 19730, 21678, and 21770.

19705 (CONF-730417-) PROCEEDINGS OF FOURTH ANNUAL SYMPOSIUM ON ENVIRONMENTAL POLLUTION, EDGEWOOD ARSENAL, MARYLAND, 4-5 APRIL 1973. Hilsmeier, A. E. (comp.). (Edgewood Arsenal, Md. (USA)). Sep 1973. 160p.

Separate abstracts were prepared for 5 of the 14 papers presented at the conference. These contained information on radioactive wastes. (HLW)

For abstracts of individual papers see: 19682-19686.

19706 (CONF-750646-1) DEFINING AND DETERMINING THE SIGNIFICANCE OF IMPACTS: CONCEPTS AND METHODS. Christensen, S. W.; Van Winkle, W.; Mattice, J. S. (Oak Ridge National Lab., Tenn. (USA)). 1975. 71p. Dep. NTIS $6.75.

From workshop on the biological significance of environmental impacts; Ann Arbor, Michigan, USA (4 Jun 1975).

The term impact is conceptually and mathematically defined to be the difference in the state or value of an ecosystem with versus without the source of impact. Some resulting problems associated with the measurement of impacts based on comparisons of baseline and operational data are discussed briefly. The concept of a significant adverse impact on a biological system is operationally defined in terms of an adverse impact which, according to a proposed decision-tree, justifies rejection of a project or a change in its site, design, or mode of operation. A gradient of increasing difficulty in the prediction of impacts exists as the scope of the assessment is expanded to consider long-term, far-field impacts with respect to higher levels of biological organization (e.g., communities or ecosystems). The analytical methods available for predicting short-term, near-field impacts are discussed. Finally, the role of simulation modeling as an aid to professional judgment in predicting the long-term, far-field consequences of impacts is considered, and illustrated with an example. (auth)

19707 (ORNL-5057) INDEXED BIBLIOGRAPHY ON TRITIUM: ITS SOURCES AND PROJECTIONS, BEHAVIOR, MEASUREMENT AND MONITORING TECHNIQUES, HEALTH PHYSICS ASPECTS, AND WASTE MANAGEMENT. Dixon, M. N.; Holoway, C. F.; Houser, B. L.; Jacobs, D. G. (Oak Ridge National Lab., Tenn. (USA)). Aug 1975. Contract W-7405-eng-26. vp. Dep. NTIS $13.60.

References are presented to the world literature on sources of tritium in the environment, the migration of tritium in the environment and uptake by biological materials, monitoring methods, health aspects, and radioactive waste management. Subject, author, and permuted title indexes are included. (CH)

19708 (STH-8/74) RADIATION EXPOSURE DUE TO DISCHARGE OF RADIOACTIVE MATERIALS WITH THE EXHAUST AIR IN THE ENVIRONMENT OF THE STADE NUCLEAR POWER STATION IN 1972 AND 1973. Ruebenberg, P.; Huber, O. (Bundesgesundheitsamt, Neuherberg/Muenchen (F.R. Germany). Abt. fuer Strahlenhygiene). Aug 1974. 20p. (In German). INIS.

8 figs.; 2 tabs.; 7 refs.

The radiation exposure of the human population in the environment of a nuclear power station due to discharge of radioactive particles with the exhaust air is calculated for the Stade nuclear power station. In this calculation, constructional parameters are considered as well as the meteorological conditions of the site. The mathematical approach to this problem is given in several calculating models. For the Stade nuclear power station with its extremely low discharge rates the radiation exposure of the human population due to radioactive materials in the exhaust air is less than 1 mrem/a. Even with a theoretical discharge rate to the maximum permissible amount, the radiation exposure would be significantly lower than the present dose limits of 30 mrem/a for the whole body and 90 mrem/a for the thyroid gland. (GE)

19709 RADIOBIOLOGICAL EFFECTS OF EMISSIONS FROM NUCLEAR POWER PLANTS. Ramos Rodriguez, E. Energ. Nucl. (Madrid); 18: No. 91, 321-324(1974). (In Spanish).

The concept of radiotoxicity is defined. The difficulties in the determination of the effects of small doses accumulated over a period of years are summarized. The ways in which radiation can affect the human body are indicated. The international protection standards are defined and outlined. Methods of radiation monitoring are outlined. (JSR)

19710 MONITORING RADIOACTIVITY IN THE ZONES AFFECTED BY NUCLEAR POWER PLANTS. Iranzo Gonzalez, E. Energ. Nucl. (Madrid); 18: No. 91, 337-341(1974). (In Spanish).

The maximum permissible dose to the population is defined and the limitations placed on radioactive emissions from nuclear installations as a result of this limitation are discussed. The monitoring programs before start-up and during operation to assure that radiation emission standards are being met are described. (JSR)

Radioactivity Monitoring and Transport

Refer also to abstracts 19695, 19707, 19770, 19777, 19778, 19799, and 19920.

19711 (AERE-PR/EMS-2) ENVIRONMENTAL AND MEDICAL SCIENCES DIVISION PROGRESS REPORT, JANUARY-DECEMBER 1974. Johnston, J. E. (ed.). (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). May 1975. 83p. Dep. NTIS (US Sales Only) $7.25. UK pounds 2.00.

The report deals with the following subjects: radiation physics (including dosimetry research, personnel dosimetry, radioactive fallout); environmental analysis; inhalation toxicology and bioanalytical group (including radiochemical and instrumentation analysis, tritium studies); medical; whole body counting (including retention studies); atmospheric pollution; chemical analysis group. (UK)

19712 (BDBw-FM-150) FALLOUT IN PRECIPITATIONS AT KOENIGSTEIN (TAUNUS) 1957-1963. Bloedorn, J. (Luftwaffenamt Inspektion Geophysikalischer Beratungsdienst, Porz-Wahn (F.R. Germany)). May 1970. 19p. (In German). INIS.

10 figs.; 9 tabs.; 8 refs. Available from ZAED.

Measured data of the gross radioactivity are compiled in tables in dependence of intensity and sum of the precipitation and of the seasonal variations. (GE)

19713 (BNWL-SA-5385) SOME STATISTICAL DESIGN AND ANALYSIS ASPECTS FOR NAEG STUDIES. Gilbert, R. O.; Eberhardt, L. L. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1975. 21p. (CONF-750548-1). Dep. NTIS $4.25.

From information meeting of the applied ecology group; Las Vegas, Nevada, USA (6 May 1975).

Some of the design and analysis aspects of the NAEG studies at safety-shot sites are reviewed in conjunction with discussions of possible new approaches. The use of double sampling to estimate inventories is suggested as a means of obtaining data for estimating the geographical distribution of plutonium using computer contouring programs. The lack of estimates of error for plutonium contours is noted and a regression approach discussed for obtaining such estimates. The kinds of new data that are now available for analysis from A site of Area 11 and the four Tonopah Test Range (TTR) sites are outlined, and the need for a closer look at methods for analyzing ratio-type data is pointed out. The necessity for thorough planning of environmental sampling programs is emphasized in order to obtain the maximum amount of information for fixed cost. Some general planning aspects of new studies at nuclear sites and experimental clean-up plots are discussed, as is the planning of interlaboratory comparisons. (auth)

19714 (CONF-720805-P1) NATURAL RADIATION ENVIRONMENT II. Volume I. Proceedings of the Second International Symposium, August 7-11, 1972, Houston, Texas. Adams, J. A. S.; Lowder, W. M.; Gesell, T. F. (eds.). (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)). 1972. 460p. Dep. NTIS $10.60.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

Separate abstracts were prepared for the 21 papers included. (CH)

For abstracts of individual papers see: 19689, 19690, 19715-19721, 19738, 19748, 19757, 19777, 19778, 19799, 19919, 19920, 20491, 20738, 21338, and 21339.

19715 (CONF-720805-P1, pp 101-133) PHYSICS OF ENVIRONMENTAL GAMMA RADIATION FIELDS. Beck, H. L. (Health and Safety Lab., New York). 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Calculated values are presented for total exposure rates and total photon fluxes and their energy and angular distributions as a function of height above the air-ground interface. Several illustrations of the use of these calculated quantities for designing instruments, interpreting data, planning field experiments, and calculating dose to people are included. (auth)

19716 (CONF-720805-P1, pp 279-303) IN-SITU MEASUREMENT OF RADIONUCLIDES IN THE ENVIRONMENT WITH A Ge(Li) SPECTROMETER. Anspaugh, L. R.; Phelps, P. L.; Gudiksen, P. H.; Lindeken, C. L.; Huckabay, G. W. (Univ. of California, Livermore). 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

A portable Ge(Li) detector has proven to be a reliable and stable probe of the environmental radiation field, and can be calibrated using point sources and theoretical calculations to provide quantitative data on the presence of any gamma-emitting radionuclide in the earth's surface. The method is most accurate when applied to the naturally occurring radionuclides, and also provides limited ability to examine disequilibrium in the thorium-232 and uranium-238 radioactive series. A powerful advantage of the method is that results with the same precision can be obtained in about 0.01 of the time required by soil sampling and conventional laboratory analysis techniques. Measurements of potassium-40 and cesium-137 are included for comparison. The primary advantage of the Ge(Li) detector and the semitheoretical calibration approach is that complex mixtures of many radionuclides can be resolved and quantitated. (auth)

19717 (CONF-720805-P1, pp 317-332) GEOGRAPHICAL VARIATIONS IN ENVIRONMENTAL RADIATION BACKGROUND IN THE UNITED STATES. Lindeken, C. L.; Peterson, K. R.; Jones, D. E.; McMillen, R. E. (Univ. of California, Livermore). 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Based on a pilot thermoluminescent dosemeter (TLD) study conducted in the spring of 1971, environmental radiation background measurements made at 107 weather stations throughout the United States showed a median exposure rate of 9.4 mu R/hr, with a range of 3.7 to 19.9 mu R/hr. Measurements were made by mailing freshly annealed CaF_2:Dy (TLD-200) dosimeters to the stations where they were exposed in the station's instrument shelter. Following a three-month exposure, the dosimeters were returned to Livermore for readout. This pilot survey adequately demonstrated the capability of the procedure for large-scale synoptic background monitoring. Measurements can be made at little expense, and only modest field effort is involved. Indeed, the number of simultaneous measurements made in this survey would be patently impractical using portable instruments. Continuation of these quarterly measurements over a multi-year period would detect any systematic change in nationwide background, as well as provide a unified surveillance network to delineate the effect of a major nuclear accident within the United States. (auth)

19718 (CONF-720805-P1, pp 369-374) ENVIRONMENTAL RADIOACTIVITY IN CERTAIN PARTS OF IRAN. Khademi, B.; Tahsili, A. (Univ., Tehran). 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Data are presented on the radioactivity in air, water, and food products in samples collected from the northern areas of Iran. A comparison of the collected data with those of other countries shows that the radioactivity of some portions of the studied areas is rather high. (auth)

19719 (CONF-720805-P1, pp 375-392) ENVIRONMENTAL RADIOACTIVITY AND RADIATION MEASUREMENTS IN TAIWAN, REPUBLIC OF CHINA. Weng, P. S.; Tsai, C. M.; Chu, T. C. (National Tsing Hua University Hsinchu, Taiwan). 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

The rather high radium content in the Peitou hot spring presents a special feature in Taiwan's natural radiation environment. The inhabitants of Peitou usually use the hot spring for both bathing and drinking. Because of the existence of the hot spring, Peitou is also a well-known resort which attracts many tourists and visitors each day. However, it is not advisable to use the hot spring for drinking, as radium-226 content is 16 times higher than the rest of Taiwan's water. Before 1964 the fallout in Taiwan was due to the nuclear weapon tests in Siberia. However, after 1964 the fallout contamination in Taiwan was due to the nuclear weapon tests at Lop Nor. As compared with other countries such as Japan and U.S.A., the agricultural products in Taiwan have shown a rather low fallout content. (auth)

19720 (CONF-720805-P1, pp 393-419) NATURAL RADIATION ENVIRONMENT OF BADGASTEIN, AUSTRIA AND ITS BIOLOGICAL EFFECTS. Pohl-Rueling, J. (Research Inst. Gastein, Salzburg, Austria); Scheminzky, F. 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Badgastein is a spa resort with hydrothermal radioactive springs, whose waters contain mainly radon-222. Results are reported from a survey on the properties of the natural radioactive environments of the area and its radiation dose levels and effects on the inhabitants and tourists. (CH)

19721 (CONF-720805-P1, pp 421-440) DISTRIBUTION IN THE ITALIAN POPULATION OF THE ABSORBED DOSE DUE TO THE NATURAL BACKGROUND RADIATION. Cardinale, A. (Agip Nucleare, Milan); Cortellessa, G.; Gera, F.; Ilari, O.; Lembo, G. 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Results are summarized of a survey on the natural background gamma radiation in Italy performed with a network of more than 1000 measurement points, for the purpose of determining the values of absorbed dose in the various areas and of identifying their correlations with the geological features of the soil. The distribution of the absorbed gamma radiation dose and the cumulative dose to the population of the different areas and of the entire country were estimated. (CH)

19722 (CONF-720805-P2) NATURAL RADIATION ENVIRONMENT II. Volume II. Proceedings of the Second International Symposium, August 7–11, 1972, Houston, Texas. Adams, J. A. S.; Lowder, W. M.; Gesell, T. F. (eds.). (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)). 1972. 959p. Dep. NTIS $13.60.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

Separate abstracts were prepared for the 32 papers included. (CH)

For abstracts of individual papers see: 19691–19699, 19723–19732, 19739–19744, 19752, 19758, 19763, 19779, 19809, 19810, and 20739.

19723 (CONF-720805-P2, pp 717-730) RADON 222 FLUX MEASUREMENTS IN WIDELY SEPARATED REGIONS. Wilkening, M. H.; Clements, W. E.; Stanley, D. (New Mexico Inst. of Mining and Technology, Socorro). 1972.

From second conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Radon-222 exhalation from the earth's surface was measured by various investigators by accumulator, flow, vertical profile, and direct charcoal absorption methods. Vertical profile measurements tend to yield higher values when compared at the same location. This method has the advantage of not disturbing the surface and of integrating over a large area; it has the disadvantage of being exceedingly difficult to correct for advective flow and terrain elevation. Spatial and time variations in flux determination are large since the radon-222 flux at a given site is dependent upon radium-226 and emanating radium-226 concentration of the soil and rocks, the porosity of the soil, and its depth. Time variations are due primarily to diurnal and seasonal changes in the atmospheric variables including especially barometric pressure and precipitation. Fluctuations in measurements at a given site over a period of months is of the order of 30 percent as determined by the standard deviation. A total of 994 measurements in this work and by other investigators yields an overall radon-222 mean flux

of 0.75 atom cm^{-2} sec^{-1} with a range from 0.01 to 2.5 atoms cm^{-2} sec^{-1}. A world-wide estimate for the total radon-222 exhalation from the land areas of the globe is 52 curies per sec. The contributions from lava covered areas, the oceans, and the ice caps of the Antarctic continent and Greenland are negligibly small. (auth)

19724 (CONF-720805-P2, pp 741-750) INDOOR AND OUTDOOR MEASUREMENTS OF NATURAL RADON AND RADON DAUGHTER DECAY PRODUCTS IN NEW YORK CITY AIR. George, A. C. (Health and Safety Lab., New York, NY). 1972.

From second conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Measurements of the concentrations of radon-222 and the concentrations and particle size distributions of the polonium-218, lead-214, and bismuth-214 daughters were made in indoor and outdoor atmospheres in New York City and in rural air. The number concentrations of airborne particles were also measured to examine their relationship with uncombined fractions of radon daughters. (CH)

19725 (CONF-720805-P2, pp 751-756) RADON-222 CONTENT IN THE INTERNAL ATMOSPHERE OF HUNGARIAN RESIDENTIAL BUILDINGS. Gemesi, J. (Silicate Industry, Budapest); Szy, D.; Toth, A. 1972.

From second conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972)

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

The use in home buildings in Hungary of some substitute materials, e.g., coal-ash, fly-ash, etc., caused greater background radiation than the traditional building materials because of their higher content of natural radioactivity. The radon-222 concentration was measured in 1182 flats (apartments) along with the concentrations of its short-lived daughter elements and radon-220 in room air and the radiation dose to the epithelium of the bronchial tubes of the lung was estimated. The average annual radon-222 concentration in open air was estimated as being 0.2 pCi/l. To confirm this estimate the radon-222 concentration in the atmosphere near the surface of the earth and its annual fluctuation was measured. (CH)

19726 (CONF-720805-P2, 757-773) BEHAVIOUR OF AIRBORNE DECAY PRODUCTS OF RADON-222 IN A BASEMENT LABORATORY. Parthasarathy, K. S. (Univ. of Leeds, Eng.); Marshall, D. H.; Burkinshaw, L. 1972.

From second conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Measurements were made of polonium-218, lead-214, and bismuth-214 in a basement laboratory under conditions of forced ventilation and no ventilation. Even though the measurements do not provide exact knowledge of the concentrations of the decay products of radon-222 in the laboratory, they lead to several interesting observations on the deposition of radioactive aerosols on surfaces. (auth)

19727 (CONF-720805-P2, pp 787-807) NATURAL RADIOACTIVITY BALANCE IN THE ATMOSPHERE OF THE SOUTHERN HEMISPHERE. Lambert, G.; Ardouin, B.; Polian, G.; Sanak, J. (CNRS, Gif-sur-Yvette, France). 1972.

From second conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

It is well known that radon-222 is a radioactive rare gas, continuously produced in the soil by the disintegration of radium-226. Radon can diffuse in the soil and is outgassed into the atmosphere from the surface of the continents at the rate of about 0.7 atoms/(cm^2-second). Whenever the soil is covered by snow or even an iceshelf, the flux of radon becomes negligible. Surficial seawater also contains radium-226 and the oceans could release into the atmosphere a part of the produced radon. Therefore a small flux of 10^{-3} atoms/(cm^2-second) can be expected from the surface of the oceans. The radon-222 half-life of 3.8 days is long enough so that the measured radon is usually of continental origin even in the middle of any main ocean. However, below 50° South, it is difficult to attribute the radon to either a continental or oceanic origin. Data are presented on seasonal and altitudinal variations in radon-220, lead-210, polonium-210, and radon-222 concentrations in air samples from various locations in the Southern Hemisphere. The relation of air mass circulation in the Antartic to radioactivity in air is discussed. (CH)

19728 (CONF-720805-P2, pp 819-831) LEAD-210 IN THE AUSTRALIAN ENVIRONMENT, 1964-70. Bonnyman, J.; Duggieby, J. C.; Molina-Ramos, J. (Commonwealth Radiation Lab., Melbourne). 1972.

From second conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Extensive monitoring studies have been made of fission products arising from nuclear weapon tests and of naturally occurring radionuclides in the Australian environment. Methods are described for the sampling and radiochemical measurement procedures for lead-210 in air, precipitation, and drinking water. The results of measurements in Australia to the end of 1970 are reported. (CH)

19729 (CONF-720805-P2, pp 883-896) DISTRIBUTION OF FALLOUT CESIUM-137 IN THE CHESAPEAKE BAY. Riel, G. K. (Naval Ordinance Lab., Silver Springs, MD). 1972.

From second conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

A technique was developed for simple analysis of ^{137}Cs concentrations in water, sediments, and biota in the fractional picocurie per liter range. These measurements are important, since fallout ^{137}Cs will be present in estuarine environments for a generation. The concentration of ^{137}Cs in water is important to studies of distribution coefficients, or concentration factors between water and sediment or organisms. Fallout ^{137}Cs is also a natural tracer, making possible experiments on a span of space and time that is impossible with intentionally added tracers. Thus, one can determine an approximate residence time for a body of brackish water with a few ^{137}Cs concentration measurements, given the average depth and typical fallout deposition rate. This estimate is good enough for first estimates as to the capacity of the body of water for various pollutants. Measurements at several sites, and at all seasonal conditions, can be used to solve the mass and concentration balance equations that more rigorously describe the hydrography of the estuary. (auth)

19730 (CONF-720805-P2, pp 917-928) CHANGING RADIATION ENVIRONMENT IN INDIA. Kamath, P. R.; Iyengar, M.A.R.; Bhat, I. S. (Bhabha Atomic Research Center, Bombay). 1972.

From second conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Observations made during the last 8 to 10 years on the radioactivity of the environments of a uranium mine and mill at Jadugoda, India, and a nuclear power station in Tarapur indicate that operation of these facilities caused a steady and increasing rise in radiation background in the vicinity of these installations. The impact of such a rise has been demonstrated by body burden measurements of the human populations and analysis of samples of indicator tissues. As these installations increase in number the presently limited radiation areas will grow to country-wide scale. The change in radiation background experienced now should be kept in view in the designing of future installations. (CH)

19731 (CONF-720805-P2, pp 929-940) NATURAL RADIOACTIVITY IN BRAZIL: A COMPREHENSIVE REVIEW WITH A MODEL FOR DOSE-EFFECT STUDIES. Pena-Franca, E.; Costa-Ribeiro, C.; Cullen, P.; Barcinski, M.; Gonzalez, D. E. (Inst. of Biophysics, V.F.R.J., Rio de Janeiro). 1972.

From second conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Regions of high natural radioactivity offer valuable opportunities for investigations on the long term consequences of chronic exposure of man to ionizing radiation. They also present opportunities for studies of translocations of heavy radionuclides from soil to man, through food chains. In Brazil two such regions are under study: the monazite sand region along the Atlantic coast of the states of Espirito Santo and Rio de Janeiro and the volcanic intrusive anomalies along a geologic fracture that extends from the coast, through the inland state of Minas Gerais. In both regions the elevated radiation background is due to the presence of high amounts of thorium and traces of uranium in minerals in the local soils and there are groups of people and villages located on variable fields of radiation, ranging from normal background to 1 mR/hr. Results are summarized from an extensive program that allowed the identification and characterization of the main features of the radiation environment in both regions. One village in each region and their surroundings were selected for intensive investigations: Guarapari, built on a peninsula over monazite sand deposits, and Araxa, over one volcanic intrusive. Two industrial plants dealing with thorium compounds were also surveyed for their radiological and health physics aspects. They present situa-

tions similar to the ones encountered in Guarapari. The information gleaned in these surveys seems to confirm the theory that lead-212 is the main source of internal irradiation, leading to the build-up of temporary body-burdens in exposed people. Results of studies of chromosome aberrations demonstrated the importance of continuing the present investigation, in order to establish a cause-effect relationship. They indicate also the possibility of observing biological effects of radiation in populations exposed to external and/or internal doses below acceptable radiation guides. (CH)

19732 (CONF-720805-P2, pp 941-947) NATURAL VERSUS THE UNNATURAL. Eisenbud, M. (New York University Medical Center, New York). 1972.

From second conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Public opinion regarding the health hazards of natural and man-made radioactivity is discussed. Numerous examples are related that illustrate the public acceptance of natural radioactivity in soils and water while insisting that much lower dose levels of environmental radioactivity resulting from the operation of nuclear facilities be reduced still further. It is pointed out that fossil fuels are radioactive and that radioactivity emissions from a fossil-fuel power plant are greater than those from a PWR nuclear power. (CH)

19733 (DP-MS-75-75) ENVIRONMENTAL SCIENCES AND COMPUTATIONS: A MODULAR DATA BASED SYSTEMS APPROACH. Crawford, T. V.; Bailey, C. E. (Savannah River Ecology Lab., Aiken, S. C. (USA)). Jul 1975. Contract AT(07-2)-1. 14p. (CONF-750706-8). Dep. NTIS $4.00.

From ERDA-wide conference on computer support on environmental science and analysis; Albuquerque, New Mexico, USA (9 Jul 1975).

A major computer code for environmental calculations is under development at the Savannah River Laboratory. The primary aim is to develop a flexible, efficient capability to calculate, for all significant pathways, the dose to man resulting from releases of radionuclides from the Savannah River Plant and from other existing and potential radioactive sources in the southeastern United States. The environmental sciences programs at SRP are described, with emphasis on the development of the calculational system. It is being developed as a modular data-based system within the framework of the larger JOSHUA Computer System, which provides data management, terminal, and job execution facilities. (auth)

19734 (HASL-294) HEALTH AND SAFETY LABORATORY ENVIRONMENTAL QUARTERLY, MARCH 1, 1975–JUNE 1, 1975. Hardy, E. P. Jr. (Energy Research and Development Administration, New York (USA). Health and Safety Lab.). 1 Jul 1975. 282p. Dep. NTIS $10.60.

Current data are presented from the HASL environmental programs, the Bhabha Atomic Research Center in Bombay, Argonne National Laboratory, NOAA Air Resources Laboratories, the Greek Atomic Energy Commission, and the National Radiation Laboratory in New Zealand. The initial section consists of interpretive reports and notes on radioactive contamination of Bombay tap water, environmental radioactivity in Greece, stratospheric concentrations of SF_6 and CCl_3F, carbon-14 measurements in the stratosphere by balloon sampling, global atmospheric distribution of krypton-85, stratospheric radionuclide inventories, strontium-90 in diet, and strontium-90 and cesium-137 in bone meal tablets. Subsequent sections include tabulations of radionuclide levels in stratospheric air, surface air, deposition, milk, diet, and tap water. A bibliography of recent publications related to environmental studies is included. (auth)

19735 (HASL-294(App.)) APPENDIX TO HEALTH AND SAFETY LABORATORY ENVIRONMENTAL QUARTERLY (MARCH 1–JUNE 1, 1975). (Energy Research and Development Administration, New York (USA). Health and Safety Lab.). 1 Jul 1975. 511p. Dep. NTIS $10.60.

Data are tabulated on: the content of ^{89}Sr and ^{90}Sr in fallout deposits sampled at various world sites; the content of stable Pb and of ^{7}Be, ^{95}Zr, ^{137}Cs, ^{144}Ce, ^{90}Sr, ^{210}Pb, ^{238}Pu, and ^{239}Pu in samples of surface air collected at various world sites; and the content of ^{90}Sr in milk and drinking water sampled in New York City during 1974. (CH)

19736 (KFK-2103UF) SUMMARY OF THE ENVIRONMENTAL EFFECTS CAUSED IN THE GERMAN FEDERAL REPUBLIC BY THE PRODUCTION AND CONSUMPTION OF ENERGY AND THE LEGISLATIVE AND TECHNICAL MEASURES FOR THEIR REDUCTION. Haury, G.; Schikarski, W.; Thoene, E. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Angewandte Systemtechnik und Reaktorphysik). Dec 1974. 177p. (In German). Dep. NTIS (US Sales Only) $12.00.

A summary is presented of the environmental impact caused by the production of energy by fossil-fuel and nuclear power plants in the Federal Republic of Germany. The legislative and technical measures for the protection of the environment are included. (JSR)

19737 (LA-UR-75-872) THEORETICAL, ANALYTICAL, AND STATISTICAL INTERPRETATION OF ENVIRONMENTAL DATA. Lombard, S. M. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 16p. (CONF-7406104-1). Dep. NTIS $4.00.

From Southeastern seminar on environmental radiation surveillance; Columbia, South Carolina, USA (Jun 1974).

The reliability of data from radiochemical analyses of environmental samples cannot be determined from nuclear counting statistics alone. The rigorous application of the principles of propagation of errors, an understanding of the physics and chemistry of the species of interest in the environment, and the application of information from research on the analytical procedure are all necessary for a valid estimation of the errors associated with analytical results. The specific case of the determination of plutonium in soil is considered in terms of analytical problems and data reliability. (auth)

Atmosphere

Refer also to abstracts 19696, 19763, 20494, and 20739.

19738 (CONF-720805-P1, pp 441-455) ESTIMATE OF TERRESTRIAL RADIATION EXPOSURE BASED UPON AERIAL SURVEYS. Oakley, D. T. (Environmental Protection Agency, Washington, DC); Moeller, D. W. 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

During the period from 1958 to 1963 aerial radiological surveys (ARMS) were conducted over approximately 25 areas in the vicinity of nuclear facilities in the USA. The population of each survey area was estimated from U.S. census data. It was found that approximately 30 percent of the U.S. population (1960 Census) resided in the survey areas, and thus it was concluded that the ARMS data would be potentially useful for making exposure estimates. The surveys were intended to provide information on radiation levels in the vicinity of nuclear installations, so that future releases of radioactive material to the environment from the facilities could be detected. In general, the facilities occupy considerably less than 1 percent of the surveyed areas, and there were no reported or obvious patterns of radionuclide deposition around the facilities. Estimates were made of the radiation dose to human populations in the areas from terrestrial gamma sources of natural and man-made radiation. (CH)

19739 (CONF-720805-P2, pp 559-588) TECHNICAL PROCEDURES FOR CHARACTERIZING THE TERRESTRIAL GAMMA RADIATION ENVIRONMENT BY AERIAL SURVEYS. Burson, Z. G.; Bovns, P. K.; Fritzsche, A. E. (EG and G, Inc., Las Vegas, NV). 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Airborne measurements of terrestrial gamma radiation are made for a variety of purposes. Aerial surveys are routinely made to define the relationship of radioactivity to soils and rocks; to prospect for uranium; to define the terrestrial radiation environment around nuclear facilities; and to determine the water equivalent of snow cover. The Aerial Radiological Measuring System (ARMS) represents a unique aerial survey system which has been used for many years to assist the US Atomic Energy Commission in monitoring the impact of nuclear facilities on their environment. The system has been effective in rapidly assessing the radiation environment over large areas. Monitoring equipment and data processing systems are described. (CH)

19740 (CONF-720805-P2, pp 589-606) AERIAL RADIOLOGICAL MEASURING SYSTEM PROGRAM. Doyle, J. F.; Boyns, P. K. (EG and G, Inc., Las Vegas, NV). 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

The present ARMS aircraft has an effective survey time of four hours. Typical survey altitudes are 300 to 500 feet for terrain surveys and up to 20,000 feet for cloud tracks. A number of special airframe modifications have been made to accommodate the various sensor systems. The ARMS radiation measurement system con-

sists of fourteen 4-inch diameter by 4-inch thick sodium iodide (NaI) detectors, a summing network for the detector signals, single and multichannel analyzers, analog computers, digital display and recording equipment, a doppler radar position computer, and strip chart recorders. Major subsystems include meteorology sensors, multispectral camera systems, and an infrared scanner for thermal mapping. Additional radiation detectors include an alpha spectrometer and a beta counter, used to count filter samples taken from a 150 cfm air sampler, which is a permanent part of the aircraft. A small lead shield houses a ½-in. x 3-in. NaI crystal for beta and gamma counting of air filter samples. Several BF_3 neutron detectors are also available for neutron counting. The raw data from the gross gamma count and the gamma spectral measurements are permanently recorded on paper tape, and they must undergo reduction and analysis for final characterization of the radiological properties of the surveyed area. (CH)

19741 (CONF-720805-P2, pp 619-640) MONTE CARLO SIMULATION OF AERIAL RADIATION MEASUREMENTS FOR DISTRIBUTED GROUND-BASED GAMMA SOURCES. O'Dell, A. A. (EG and G Inc., Goleta, CA). 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Problems in the interpretation of aerially measured data for quantitative assessment of ground level exposure (dose rate) for finite gamma source distributions on and in the ground are discussed. Monte Carlo techniques were utilized to calculate the gamma flux energy spectrum at flight altitude and at positions near the air-ground interface. From these results the total flux and gross detected count rate at altitude and the exposure dose rate near the interface can be determined. (auth)

19742 (CONF-720805-P2, pp 775-786) TROPOSPHERIC AEROSOL RESIDENCE TIMES INDICATED BY RADON AND RADON-DAUGHTER CONCENTRATIONS. Moore, H. E.; Poet, S. E.; Martell, E. A. (National Center for Atomosphere Research, Boulder, CO). 1972.

From second conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

The data are presented that lead to the conclusion that residence times calculated on the basis of the steady-state assumption applied to various radon and radon daughter isotope ratios can be very misleading. Because of the limitations noted in regard to the the use of the radon-222/lead-210 and polonium-210/lead-210 ratios, the best estimates of the mean aerosol residence times in the troposphere appear to be those calculated from observed or corrected bismuth-210/lead-210 ratios. Based upon these ratios as well as on the variation in lead-210 concentration with altitude over continental land masses, the mean aerosol residence time is estimated to be 4 days or less near the earth's surface to increase by a factor of 2 or more with altitude within the troposphere. It appears that the polonium-210 isotope is useful only as an index of the presence of soil particles. It is concluded that better estimates of aerosol residence times can result only by an increased number and variety of experimental isotopic measurements combined with more complicated models of atmospheric transport. The usefulness of such measurements in assessing the relative contributions of various aerosol sources is illustrated. (auth)

19743 (CONF-720805-P2, pp 809-818) ARTIFICIAL SOURCES OF NATURAL RADIONUCLIDES IN ENVIRONMENT. Jaworowski, Z.; Bilkiewicz, J.; Kownacka, L.; Wlodek, S. (Central Laboratory for Radiological Protection, Warsaw). 1972.

From second conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Burning of fossil fuel may be one of the sources of radium-226 and lead-210 in the atmosphere. In coal the concentrations of radium-226 were reported as 0.001 to 1.3 pCi per gram. In Polish coal the mean concentration found is 0.3 pCi per gram. Assuming that this is the mean world concentration of radium-226 in coal the total of 2×10^{15} grams of coal burned per year in the whole world contains about 600 Curies of radium-226. The collecting efficiency of the dust collectors used in the power plants ranges from 75 to 99.8 percent. The mean fraction of the burned coal solids transferred to the atmosphere of the Earth is usually higher than might be inferred from the performance of high efficiency collectors, and is accepted as being 0.34 to 6.0 percent. With the maximum value of the fraction transferred to the atmosphere about 150 Curies of radium-226 will be dispersed each year. If dispersed uniformly over the Earth's surface this amount of radium-226 would correspond to a fallout rate of 0.3 pCi/m^2 per year or 0.0004 pCi per liter of rainwater, assuming that 800 mm per year is the mean precipitation rate. As the emission of fly ash takes place near the ground, such uniform dispersion is improbable and much higher local deposition should be expected. (CH)

19744 (CONF-720805-P2, pp 833-836) CONCENTRATIONS OF KRYPTON-85 IN AIR. Jaquish, R. E.; Johns, F. B. (Environmental Protection Agency, Las Vegas, NV). 1972.

From second conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

The measurements of ^{85}Kr in surface air samples collected in Las Vegas, Nevada, over a one-year period are comparable with those made elsewhere in the northern hemisphere. From the measurements made over the one-year period, it was not conclusive if there was an increase in concentration during that time. Further investigation is necessary, but it does appear that there are fluctuations in the atmospheric ^{85}Kr concentrations. This could be caused by the discontinuous release of ^{85}Kr from fuel reprocessing plants and the time required for uniform mixing in the atmosphere. (auth)

19745 (RD/B/N-3337) MODIFICATIONS TO THE CLOUD-GAMMA CALCULATION IN THE ENVIRONMENTAL PROGRAM WEERIE. Corbett, J. O. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Mar 1975. 14p. Dep. NTIS (US Sales Only) $4.00.

Modifications are described which make the program WEERIE easier to use and improve the accuracy of its calculation of external γ dose from a radioactive plume. A new subroutine sets the angular range for the cloud-γ integration, so that it no longer needs to be specified by the user, and a correction to the radial range makes proper allowance for the attenuation of γ rays. A calculation using the semi-infinite cloud approximation has been added for comparison. A mathematical discussion is presented, followed by numerical examples and instructions to the user. (auth)

19746 SOME ATTEMPTS TO INTERPRET THE VARIATIONS WITH TIME OF MONTHLY DEPOSITIONS OF ^{210}Pb, ^{7}Be, ^{137}Cs AND ^{144}Ce. Matsunami, T.; Mizohata, A.; Mamuro, T. Annu. Rep. Radiat. Center Osaka Prefect.; 15: 24-29(1974).

Monthly depositions of ^{210}Pb, ^{7}Be, ^{137}Cs and ^{144}Ce have been measured at out laboratory for the past several years by the basin method. In this article are summarized the results of observation and are presented some attempts to explain the variations with time of the depositions. There have been very few studies on the ^{210}Pb deposition. According to the present study, the seasonal variation of ^{210}Pb deposition were quite similar to those of ^{7}Be and ^{137}Cs depositions, and it was concluded that considerably large fraction of ^{210}Pb deposition originates from the stratospheric reservoir. Peaks other than spring maxima appearing in the variation of ^{137}Cs deposition were attributed to fresh nuclear debris injected into the troposphere by new explosions. Further, by analyzing fine soil samples collected around the basins the contribution of "redeposition" was evaluated for each of ^{210}Pb, ^{7}Be, ^{137}Cs and ^{144}Ce. (auth)

19747 INVESTIGATIONS ON THE RADIOACTIVITY OF AEROSOLS IN THE ATMOSPHERE AND ON THE FALLOUT IN THE REGION OF WROCLAW CITY. Glowiak, B. (Technical Coll., Wroclaw); Pacyna, J. Staub, Reinhalt. Luft.; 34: No. 5, 154-156(May 1974).

The present levels of radioactivity in the air of Wroclaw, Poland, is discussed. Strontium-90 and ^{137}Cs were studied since they are the most dangerous radionuclides to humans. A correlation was determined between the radioactivity of atmospheric aerosols and that of fallout. Models constructed by Martin and Freiling were applied. (Pollut. Abstr.)

Soil

Refer also to abstracts 19278, 19283, 19372, 20011, and 20024.

19748 (CONF-720805-P1, pp 333-345) NATURAL AND FALLOUT GAMMA NUCLIDES IN INDIAN SOILS. Mishra, U. C. (Bhabha Atomic Research Centre, Bombay). 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Undisturbed soil samples collected throughout India from various areas and depths were examined by gamma spectrometry for natural radioactivity and fallout radionuclides, with emphasis on ^{137}Cs. It is proposed to cover the entire country as regards the natural radioactivity estimations and conduct a detailed survey of

the areas showing anomalies. It is proposed to continue sampling and measurements of fallout gamma nuclides once a year at 5 or 6 selected stations so that the rate of deposition, elimination, or redistribution can be studied over long time periods. (CH)

19749 (ORNL-TM-4743) RECONNAISSANCE SURVEY OF THE INTERMEDIATE LEVEL LIQUID WASTE TRANSFER LINE BETWEEN X-10 AND THE HYDROFRACTURE SITE. Duguid, J. O.; Sealand, O. M. (Oak Ridge National Lab., Tenn. (USA)). Aug 1975. Contract W-7405-eng-26. 24p. Dep. NTIS $4.25.

Two leakage points on an intermediate-level liquid waste line were located. The waste line is used periodically to transfer waste between X-10 and the hydrofracture site. The first leak had occurred prior to this survey and had been repaired. However, no contaminated soil had been removed. The second leak had not been discovered previously and soil contamination in this area was more intense than at the first leak. Analyses of soil samples taken from both locations are given in this report. Groundwater data that indicate the effectiveness of the removal of the contaminated material from leak two are presented. (auth)

19750 FUNDAMENTAL STUDY ON LONGITUDINAL DISPERSION OF TRITIATED WATER THROUGH SATURATED POROUS MEDIA. Fukui, M.; Katsurayama, K. (Kyoto Univ.). Health Phys.; 28: No. 6, 717-725(Jun 1975).

Dispersion phenomena of ions or molecules through porous media are found not only in engineering fields such as the process of ion exchange and filtration, but in natural hydro-systems. Recently the pollution of underground water due to industrial wastes has been discussed, and it is important to forecast the behavior of pollutants. The purpose of this paper is to investigate the effect of the average axial velocity of flow, the effect of size and the shape of porous media and flow length on the dispersion coefficient in more detail, and to examine the application of diffusion type equations to dispersion phenomena. Moreover, numerical analysis of the diffusion equation was tried under a boundary condition of variable concentration, which was not solved analytically in general, and the solutions were compared with the break-through curves under such conditions. (auth)

Water

Refer also to abstracts 19698, 19699, and 19767.

19751 (AED-CONF-73-697-000, pp 43-55) TRANSPORT MECHANISMS OF RADIOACTIVE SUBSTANCES IN THE WATER CYCLE. Muennich, H. 1973. (In German).

From meeting of the Schutzkommission by the Bundesministerium des Innern; Goettingen, F.R. Germany (Jun 1973).

7 figs.; 17 refs.

In Schutzkommission by the Bundesministerium des Innern. Papers presented at the meeting at Goettingen. (Bundesministerium des Innern, Bonn (F.R. Germany). Abt. Reaktorsicherheit und Strahlenschutz).

The present distribution of long-lived fallout products from nuclear explosions (tritium and ^{14}C, for the most part) in ground water, open inland waters, and oceans is presented graphically. The data are employed for a discussion of the transport mechanism of atmosphere-rain-washout-water. These mechanisms are to provide facts about the presumable distribution of conventional environment-contaminating materials in a time of 10 to 50 years. (GE)

19752 (CONF-720805-P2, pp 897-916) NATURAL ACTIVITY IN HUDSON RIVER ESTUARY SAMPLES AND THEIR INFLUENCE ON THE DETECTION LIMITS FOR GAMMA EMITTING RADIONUCLIDES USING NaI GAMMA SPECTROMETRY. Wrenn, M. E. (New York Univ. Medical Center, New York); Jinks, S. M.; Hairr, L. M.; Paschos, A. S.; Lentsch, J. W. 1972.

From second conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Sources of natural radioactivity in Hudson River Estuary are described. The technique of analysis for gamma spectrometry of environmental samples is presented and its pros and cons discussed. The distribution of natural radioactivity in water, biota and sediment was reported as well as the role played by the vertical distribution of cesium-137 in sediments as an indicator of the rate of sedimentation. The effect of the presence of natural radionuclides on the detection limits of man-made nuclides in the Hudson River environment is thoroughly examined. The results obtained with a 4-in. sodium iodide well crystal housed in a low background mercury shielding compare favorably with a more sophisticated Ge(Li) system which uses anticoincidence, as far as the analysis of environmental samples is concerned. (auth)

19753 (COO-3566-11) DISTRIBUTION OF LEAD-210 AND POLONIUM-210 BETWEEN SOLUBLE AND PARTICULATE PHASES IN SEAWATER. Spencer, D. W. (Woods Hole Oceanographic Institution, Mass. (USA)). 1975. 105p. Dep. NTIS $8.25.

Results are reported from radiometric measurements of the distribution of ^{210}Pb and ^{210}Po in surface seawater and suspended particulate matter. Samples of plankton and sediments collected from some locations were also analyzed. Samples of seawater and suspended particulate matter were collected from stations located in the Gulf of Maine, the North Atlantic, and approximately 500 miles southwest of Gibraltar. (CH)

19754 DISTRIBUTION OF RADIOISOTOPES BETWEEN PHYTOPLANKTON, SEDIMENT, AND SEA WATER IN A DIALYSIS COMPARTMENT SYSTEM. Dawson, R.; Duursma, E. K. (International Atomic Energy Agency, Monaco-Ville, Monaco). Neth. J. Sea Res.; 8: No. 4, 339-353(Dec 1974).

The distribution of the radioisotopes ^{36}Cl, ^{54}Mn, ^{59}Fe, ^{60}Co, ^{65}Zn, ^{90}Sr, ^{106}Ru, ^{109}Cd, ^{110m}Ag, ^{137}Cs, ^{144}Ce, ^{147}Pm and ^{204}Tl between seawater, Mediterranean Sea sediments in suspension, and the phytoplankton species Phaeodactylum tricornutum was studied by using a competitive technique in which the various phases were separated by dialysis membranes. The radioisotopes were introduced into the seawater compartment and the radionuclide uptake by sediment and phytoplankton occurred in the adjoining compartments after the isotopes had diffused through the membranes. On the examination of the distribution coefficients, the isotopes ^{90}Sr, ^{110m}Ag, ^{204}Tl and in particular ^{109}Cd, had higher affinities towards Phaeodactylum tricornutum than towards the Mediterranean Sea sediments. The isotopes ^{54}Mn, ^{60}Co and ^{137}Cs had lower distribution coefficients with the phytoplankton than with sediment and in the case of ^{59}Fe, ^{65}Zn, ^{106}Ru, ^{144}Ce and ^{147}Pm, the distribution coefficients were similar for both phytoplankton and sediment. (NL)

19755 EFFECT OF URANIUM ORE MINING ON ^{226}Ra CONTENT IN SURFACE WATER, REED, AND FRESHWATER FISH. Martinec, M. (Regional Hygienic Station, Usti nad Labem, Czech.). Cesk. Hyg.; 18: No. 10, 475-478(Dec 1973). (In Czech).

The content of radium-226 was studied in water, fish, and reed of a lake in order that the contaminating effect be ascertained of waste water discharged during uranium ore mining. The content of ^{226}Ra in water was observed to increase from 3 pCi/l up to 20 pCi/l. A significant increase was also found for fish and reed. While a detailed analysis of the radionuclide content in carp shows the highest values of ^{226}Ra in the scales and in the bones, its concentration in flesh did not exceed the values given for the natural content of ^{226}Ra in foodstuff, i.e., 0.1 to 12 pCi/kg. (Nuclear Sci. Abstr. Czech.)

Ecosystems and Food Cycles

Refer also to abstract 20027.

19756 (BNWL-SA-5403) TECHNIQUES FOR LONG-TERM CONTROLLED STUDIES OF PLANT UPTAKE OF TRANSURANICS. Hinds, W. T.; Cline, J. F. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1975. 17p. (CONF-750503-26). Dep. NTIS $4.00.

From 4th national symposium on radioecology; Corvallis, Oregon, USA (12 May 1975).

The development of techniques and equipment for determining the fate of transuranics released into terrestrial ecosystems is discussed. Experimental facilities at Hanford are described. Evidence that processes associated with weathering, or aging, or both, can increase the uptake of transuranics from soil by plants is discussed. (CH)

19757 (CONF-720805-P1, pp 347-367) LEAD-210, POLONIUM-210, AND STABLE LEAD IN THE FOOD-CHAIN LICHEN, REINDEER AND MAN. Persson, B. R. (Univ., Lund, Sweden). 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

The measurements of stable lead and the natural fallout radionuclides lead-210 and polonium-210 in communities of lichen (Cladonia alpestris) in central Sweden from 1961 to 1970 indicate a quite constant level. The average lead-210 content per unit area in lichen carpets was found to be 15 +- 2 nCi m^{-2}, the average lead-210 activity concentration 6,7 +- 0,9 nCi per kg dry weight and the lead-210 specific activity 630 +- 60 nCi per g of stable lead. The polonium-210/lead-210 activity ratio was about 0,9 +- 0,1. The vertical distribution of lead-210 in the lichen carpet

showed a maximum concentration in the top layer. The distribution was similar during 1967 and 1968 but the low amount of precipitation during 1968 and 1969 disturbed the distribution pattern in 1969 and 1970. The transfer of lead-210, polonium-210 and stable lead through the food chain: lichen, reindeer, and man was characterized. The absorbed dose rate in Lapps due to polonium-210 was estimated to be about 6 to 8 mrad per year in gonads and 8 to 20 mrad per year in bone tissues. This is about ten percent of their entire absorbed dose contribution from all natural radiation sources. (auth)

19758 (CONF-720805-P2, pp 837-844) NATURAL RADIOACTIVITY LEVELS IN SOME DRINKING MINERAL WATER IN ITALY, AND RELATED DOSES TO THE POPULATION. Allegrini, M. (Univ., Pavia, Italy); de Bortoli, M.; Gaglione, P.; Lanzola, E.; Mastinu, G.; Santaroni, P. 1972.

From second conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

The large scale consumption of mineral waters in Italy is continuously increasing, as can be seen from the amount of bottled mineral water produced during the last ten years. The mineral waters were studied for their natural radioactivity content and to estimate their contribution to the total dietary intake and radiation dose to the human population. Radium-226 and lead-210 levels were measured in 65 of the most widely used Italian mineral waters, which were chosen to cover the geographic distribution of the mineral springs. (auth)

19759 (UCRL-76570(Rev.2)) ROLE OF SOLUBLES AND PARTICULATES IN RADIONUCLIDE ACCUMULATION IN THE OYSTER CRASSOSTREA GIGAS IN THE DISCHARGE CANAL OF A NUCLEAR POWER PLANT. Harrison, F. L.; Wong, K. M.; Heft, R. E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 8 Aug 1972. 39p. (CONF-750503-26). Dep. NTIS $5.00.

From 4th national symposium on radioecology; Corvallis, Oregon, USA (12 May 1975).

Changes in ^{54}Mn, ^{60}Co, ^{65}Zn, and ^{137}Cs concentrations were followed in oysters introduced into a discharge canal receiving low-level radioactive waste from a boiling water reactor. Groups of animals were maintained either in filtered or nonfiltered discharge-canal water. They were sampled immediately before and after single radioactive releases and at one-day intervals thereafter. Radionuclide concentrations were determined also in the water and in suspended and settled particulates. In the canal water, concentrations changed rapidly during a release, reaching peak values within 30 minutes. The partition between soluble and particulate (filterable) phases in the water differed with the radionuclide. Continuous sampling of suspended particulates after single releases showed considerable variation in concentrations per liter of water for each radionuclide. Comparisons of animals held in filtered water to those in nonfiltered water showed similar concentrations only for ^{137}Cs. Results indicate that suspended particulates play an important role in the accumulation of some radionuclides and that resuspension of particulates is an important source between periods of releases. (auth)

19760 RADIONUCLIDE UPTAKE BY SOME FRESHWATER HYDROBIONTS. Dushauskene, N. R. F.; Marchyulenene, E. D. P.; Nyanishkene, V. B.; Shuliene, R. I.; Polikarpov, G. G. (Inst. of Botany, Vilnyus, USSR). Liet. TSR Moksl Akad. Darbai, Ser. C; 3: No. 59, 201-212(In Russian).

On the basis of the research carried out in 1967 to 1968 in natural environment it was concluded that values of the accumulation coefficients of ^{90}Sr and ^{210}Pb are the same in fish and molluscs, while the accumulation coefficients of ^{210}Pb in aquatic plants appear to be an order lower than those of ^{90}Sr. A correlative bond for fish was found to be between the ^{90}Sr and ^{210}Pb concentrations. Value dependence of the accumulation coefficients of ^{90}Sr, ^{210}Pb on ash amount of hydrobionts was also revealed. It was established by experiments that ^{90}Sr, ^{144}Ce, ^{137}Cs, and ^{106}Ru accumulate in phytoplankton and silt with maximum coefficients. Among different radionuclides, ^{144}Ce was found to exhibit the highest accumulation coefficient in hydrobionts, while in ^{137}Cs. ^{90}Sr accumulates in hydrobionts and silt with relatively low accumulation coefficients. When intensively accumulating ^{137}Cs, ^{144}Ce, and ^{106}Ru from the water, silt protects simultaneously the larvae of chironomid from the absorption of the mentioned radionuclides. The chironomid larvae may assimilate the following amounts of radionuclides from radioactive food: ^{90}Sr–10, ^{137}Cs–9, ^{144}Ce–11, ^{106}Ru–6%. The year old carps assimilate from the radioactive food 10% of ^{144}Ce of its total amount transfered by them with food (chironomids) through the gastrointestinal tract. The uptake of ^{90}Sr, ^{144}Ce, ^{137}Cs, and ^{106}Ru by the organism of dreissen and chironomid larvae, the ^{90}Sr uptake by the organism of limnea, ^{144}Ce by the organism of year old carps occur chiefly from the water in low quantities if food or feeding is available. It was concluded that in natural environment the fish of different trophic levels (carp and predatory) exhibit the same ability of the ^{90}Sr accumulation. Analogical dependence appears to be the same for ^{210}Pb as well. The accumulation coefficients of every radionuclide of the fish do not depend on their feeding type. (auth)

19761 CAESIUM-137: ITS ACCUMULATION IN A LITTORAL COMMUNITY. Broom, M. J.; Grimwood, P. D.; Bellinger, E. G. (Manchester Univ., Eng.). Mar. Pollut. Bull.; 6: No. 2, 24-26(Feb 1975).

The low-level radioactive liquid wastes which arise at the U. K. nuclear fuel reprocessing plant at Windscale on the Cumbria coast are discharged into the Irish Sea. These wastes are initially dispersed but they can also become reconcentrated in marine organisms. The present work discusses the concentrations of ^{137}Cs relative to those of potassium in the various stages of marine food chains and shows that discrimination occurs in favor of ^{137}Cs over potassium during the transfer between the different trophic levels. (auth)

19762 ^{137}Cs CONTENT IN JAPANESE DIET FROM 1963 TO 1971. Suzuki, Y.; Nakamura, R.; Kawachi, E.; Ueda, T. (National Inst. of Radiological Sciences, Chiba (Japan)). J. Radiat. Res.; 15: No. 4, 181-188(Dec 1974).

Cesium-137 level in the total diet of Japanese reached the highest peak (107 pCi/day/person) in 1964, and then decreased year by year. The ^{137}Cs level in 1971 was less than 10% of the maximum value in 1964. Daily intake of stable cesium through the total diet has been in the range of 3.9 μg and 25.1 μg. The specific activities (^{137}Cs pCi/mg of stable Cs) of total diet were found to vary among districts. Average ratio of Cs atom to one million atoms of potassium in the diet was 1.7 ± 0.7. Contribution of nine foodstuffs to the total intake of ^{137}Cs was calculated, and that of cereals was the highest and amounted to approximately 40% of the total ^{137}Cs intake. Using (^{137}Cs)-K observed ratio ($OR_{human\ body-total\ diet}$) for the Japanese adults of 2.35, the cumulative internal radiation dose to the whole body due to ^{137}Cs was estimated to be 7.3 mrads during the 9-year period from 1963 to 1971. (auth)

Radiometric Techniques

Refer also to abstracts 19305, 19332, 19689, 19707, 19753, and 19911.

19763 (CONF-720805-P2, pp 607-618) AERIAL SNOW GAUGING USING NATURAL TERRESTRIAL GAMMA RADIATION. Fritzsche, A. E.; Burson, Z. G. (EG and G, Inc., Las Vegas, NV). 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Aerial snow gauging using the transmitted terrain gamma radiation has been shown to be practical. The accuracy of about 10 percent is expected to improve as techniques for evaluating airborne radon-daughter contributions are developed, and as the peak area extraction from spectral data is perfected. Both the gross count and peak area techniques illustrated will provide this accuracy. (auth)

19764 (JUL-1131-ST) TRACER EXPERIMENTS ON THE DISPERSION OF PLUMES OVER TERRAIN OF MAJOR SURFACE ROUGHNESS. Vogt, K. J.; Geiss, H. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Zentralabteilung Strahlenschutz). Oct 1974. 19p. (AED-CONF-74-687-001). INIS.

From 1st Asian regional congress on radiation protection; Bombay, India (15 Dec 1974).

10 figs.; 5 tabs.; 25 refs. with abstract.

Atmospheric diffusion parameters for ^{64}Cu were used to calculate short-time diffusion factors for the various exposure pathways. The long-time diffusion factors, representing the annual concentration distributions in the different sectors of the windrose, were computed by superposition of the short-time concentrations according to the 3-dimensional frequency distribution of wind direction, wind velocity and diffusion category. When using Pasquill's diffusion parameters for sites featuring a surface roughness similar to Juelich, the maximum of the long-time distribution curve is underestimated by about the factor 5 as against the values obtained in the course of the Juelich diffusion experiments at the usual emission heights. In those cases where the 3-dimensional frequency distribution at a location has not been

measured, it is possible to determine its long-time diffusion factors by approximation; this is done by classification of such location into a base siting category, for which diffusion-climatological statistics are available, and by superposition of the wind direction distribution of this specific site on the distribution functions computed for these statistics. (GE)

19765 DISTRIBUTION OF SOME FISSION PRODUCT RADIONUCLIDES IN SEA AND ESTUARINE SEDIMENTS. Hetherington, J. A.; Jefferies, D. F. (Ministry of Agriculture, Fisheries and Food, Lowestoft, Eng.). Neth. J. Sea Res.; 8: No. 4, 319-338(Dec 1974).

As part of a scientific program to assess the consequences of the discharge of radioactive liquid effluents from the Windscale fuel reprocessing plant, regular measurements have been made over a number of years of the radioactivity associated with seabed and estuarine sediments in the area. Results of these surveys are given and relationships derived between the degree of contamination of bottom sediments, the rates of discharge of individual radionuclides, and the distance from the Windscale outfall. Some measurements are also reported on the distribution of radionuclides with respect to depth in sediment. The influence of particle size and the organic content of sediments on the reconcentration factors of sediments is examined. (NL)

19766 THE RADIOCARBON CLOCK. Huebner, R. Fermelde-Praxis; 51: No. 18, 751-761(Sep 1974). (In German).

In importance of the radiocarbon method for age determination is discussed. Possible error sources are estimated and the calibration and correction of a carbon clock is shown. Finally the most usual methods for sample investigation with respect to ^{14}C content are described. (GE)

19767 ESTIMATION OF THE RATE OF PRECIPITATION RECHARGE TO THE GROUNDWATER BY TRITIUM MEASUREMENTS. Tanaka, K. (Gakushuin Univ., Tokyo (Japan). Faculty of Science). Chikyu Kagaku; 7-8: No. 1, 9-16(Jun 1974). (In Japanese).

This paper presents the discussion on the balance of water and the transport of tritium among three geohydrologic zones of Musashino groundwater basin. The discussion leads the estimation of the annual recharge to the groundwater from precipitation assuming the following data: time variation of tritium content in precipitation; time variation of tritium content in the unconfined groundwater; quantities of pumped out water from the confined groundwater; and tritium distribution of the whole basin. In Musashino groundwater basin, this estimation gives the value of 0.50 ± 0.16 m/y for the rate of precipitation recharge to the ground water. (auth)

19768 Sr ISOTOPIC COMPOSITIONS OF SOME RYOZEN VOLCANIC ROCKS FROM THE NORTHEASTERN PART OF FUKUSHIMA PREFECTURE. Shuto, K. (Tokyo Univ. of Education (Japan). Faculty of Science); Yashima, R. Ganseki Kobutsu Kosho Gakkaishi; 69: No. 11, 373-380(Nov 1974). (In Japanese).

Rb and Sr concentrations and Sr isotopic compositions ($^{87}Sr/^{86}Sr$) have been determined for five basalts, four andesitic basalts, one andesite, and one obsidian of the Ryozen formation. These eleven volcanic rocks have initial $^{87}Sr/^{86}Sr$ ratios ranging from 0.7033 to 0.7046. These ratios may be nearly identical among the different rock types. The $^{87}Sr/^{86}Sr$ ratios of the basaltic rocks are slightly higher than those of oceanic ridge tholeiities but very similar to those of tholeiitic basalts from Hawaiian Islands and type II island arc such as the Izu-Bonin Island, Mariana Islands, Fiji Islands, and New Britain Islands. On the other hand, the $^{87}Sr/^{86}Sr$ ratios of acid members are very similar to those of acid volcanic rocks from Type II island arc and they also lie in the lower part of the range measured in acid volcanic rocks from Type I island arc such as the Japanese Islands and New Zealand, and from Cenozoic orogenic belt in the United States and Central America. The Rb concentrations and K/Rb ratios of basaltic rocks in the Ryozen formation are nearly comparable to those of the tholeiitic basalts from Hawaiian Islands and Type II island arc, while the Sr concentrations are close to those of oceanic ridge tholeiites. Considering from the results of the present work and previous petrological studies, it may be concluded that the siliceous basaltic and acid volcanic rocks of the lower and upper horizons are derived by fractional crystallization of olivine tholeiitic magma which produces olivine basalts in the middle horizon. An alternative possibility is that olivine tholeiitic, siliceous basaltic, and acid magmas may be derived directly from certain upper mantle material presumably of peridotitic composition, which has $^{87}Sr/^{86}Sr$ ratios around 0.704. (auth)

Site Surveys

19769 (BNWL-1885) AVIFAUNA OF WASTE PONDS ERDA HANFORD RESERVATION, BENTON COUNTY, WASHINGTON. Fitzner, R. E.; Rickard, W. H. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jun 1975. Contract (AT(45-1)-1830. 96p. Dep. NTIS $7.60.

The presence of small ponds on the Hanford 200 Area plateau provides attractive habitats for birds. During a 29-month period, 126 bird species were observed utilizing these ponds, their associated vegetation, and air space. Waterfowls are the important agents of dispersal of radionuclides from waste ponds based on food habits, abundance, migratory habits, and importance as food in the diet of people. Abundance, long residence time, and food habits identify the American coot as the single most important species to be considered in the biological dispersal of radionuclides from waste ponds. (auth)

19770 (NVO-269-23) AMCHITKA RADIOBIOLOGICAL PROGRAM PROGRESS REPORT, JANUARY 1974-December 1974. Nelson, V. A.; Seymour, A. H. (Washington Univ., Seattle (USA). Coll. of Fisheries). May 1975. Contract AT(26-1)-269. 52p. Dep. NTIS $4.00.

Results are summarized of analyses of samples collected from 1970 to 1974 in the Amchitka Island area and include analyses for gamma-emitting radionuclides in air filters, seawater, freshwater, birds, lichens, marine algae, marine invertebrates, fish, aufwuchs, and freshwater moss and plants; ^{90}Sr in rats and birds; and tritium in seawater, freshwater, and biological organisms. Monitoring of background radiation with survey instruments was added to the 1974 program and the results of the survey are included. (auth)

19771 (UCRL-51830) EXAMINATION OF THE GEOLOGY AND SEISMOLOGY ASSOCIATED WITH AREA 410 AT THE NEVADA TEST SITE. Hannon, W. J.; McKague, H. L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 23 May 1975. Contract W-7405-Eng-48. 35p. Dep. NTIS $4.75.

This report summarizes regional and local geology at the Nevada Test Site and identifies major tectonic features and active faults. Sufficient information is given to perform seismic safety analyses of present and future critical construction at the Super Kukla Site and Sites A and B in Area 410. However, examination of local minor faults and joints and soil thickness studies should be undertaken at construction time. The Cane Spring Fault is identified as the most significant geologic feature from the viewpoint of the potential seismic risk. Predictions of the peak ground acceleration (0.9 g), the response spectra for the Safe Shutdown Earthquake, and the maximum displacement across the Cane Spring Fault are made. (auth)

Thermal Effluents

Refer also to abstracts 19706, 21626, and 21680.

19772 (EPA-660/3-75-014) FLOW ESTABLISHMENT AND INITIAL ENTRAINMENT OF HEATED WATER SURFACE JETS. Stefan, H.; Bergstedt, L.; Mrosla, E. (Minnesota Univ., Minneapolis (USA). St. Anthony Falls Hydraulic Lab.). May 1975. 142p.

Mathematical models to predict water temperature distributions resulting from heated water surface discharges usually consider three subregions of the flow field: an outlet region or zone of flow establishment (ZFE); a zone of fully established jet flow; and a far field with mostly passive dispersion. Of these three regions, the second zone can be treated mathematically most readily using integral techniques; the third zone requires input specifying mean flow and turbulence of the ambient flow field; and the first zone depends essentially on the geometry of the outlet and the discharge characteristics in terms of the velocity and temperature of the water. The results of an experimental study dealing with the outlet region zone are reported. The discharge channel had a rectangular cross section and led into a deep, wide reservoir. The aspect ratio (width-to-depth ratio) of the channel, the volumetric discharge rate, and the discharge temperature were varied. A cross-flow was imposed in some of the experiments. (auth)

19773 THERMAL EFFECTS OF NUCLEAR POWER PLANTS. Nieto Garcia, M. Energ. Nucl. (Madrid); 18: No. 91, 349-354 (1974). (In Spanish).

The thermal contamination resulting from open and closed loops in nuclear power plants is summarized. The components of the ecosystem which can be affected by the thermal contamination are indicated. The effect of the increase of the temperature on the oxygen content of water is reviewed. Thermal effects on sea life are evaluated. The thermal specifications placed on nuclear power plants in order that river plants and animals not be affected are summarized. (JSR)

19774 RECENT TREND OF CONTROL STANDARD FOR PREVENTION OF THERMAL POLLUTION. Genshiryoku Kogyo; 20: No. 7, 9-11(Jul 1974). (In Japanese).

The thermal pollution by nuclear power plants is now a serious environmental problem. The investigation to control the thermal pollution has been made since 1971. The country can regulate it by the law for the prevention of water pollution. The method of establishing standard for discharging warm water is according to the maximum temperature of water discharge, difference of temperature between the water at intake and outlet, difference of water temperature in diffusing area, and temperature difference between environmental water and discharged water. Sometimes, the regulation can be made by administrative guidance. The standards set by this method are according to the permissible limit of temperature of outgoing water, difference of temperature between the water at intake and outlet, water temperature in diffusing area, and temperature difference between environmental water and discharged water. Others to be determined for the prevention of thermal pollution are type of industry and scale of factory to be controlled, measuring equipments, and method of investigation of the effect on environment. At present, it is very hard to evaluate the effect of thermal pollution on fish or seaweeds. The most proper temperature for fish or seaweeds may exist. Method to know the effect on marine organisms due to the change of temperature is very difficult to establish. Physical or chemical action of warm water may have other effect on fish or seaweeds. (JA)

Chemical Effluents

Refer also to abstracts 19251, 19277, 19706, 19707, and 19734-19736.

19775 ENVIRONMENTAL BEHAVIOR OF BINUCLEAR (Ru-O-Ru) COMPLEX DERIVED FROM RUTHENIUM TETRAOXIDE. Ishiyama, T.; Matsumura, T.; Honda, Y. Annu. Rep. Radiat. Center Osaka Prefect.; 15: 38-40(1974).

Environmental behavior of prepared binuclear (Ru-O-Ru) complex, $[RuO_2(NO)_2NO_3]_2O$, was investigated by paper chromatography and infrared absorption spectra of a decomposition product in fresh water. It was found that about 90 per cent of the total Ru in the solution was taken up in the fraction with R_f less than 0.2, corresponding to mononitro-, mononitrato- and uncomplexed (RuNO) species from paper chromatography. The proportion of R_f 0-0.2 and R_f 0.2-1.0 to total Ru was scarcely altered with increasing the the aging time over one day. On the basis of infrared spectra of decomposition product by aging the (Ru-O-Ru) complex, it was confirmed that two oxide anions, nitrosyl, nitro, nitrato groups and water molecule are all coordinated to Ru metal. It was proposed that one of the chemical formula of anionic species obtained by decomposition of (Ru-O-Ru) complex might be given as $[RuO_2(NO)(NO_2)(NO_3)(H_2O)]^-$ anion. (auth)

INSTRUMENTATION

Radiation Detection Instruments

Refer also to abstract 20640.

General Detectors and Monitors

Refer also to abstracts 19274, 19689, 19714, 19716, 19722, 19919, 19920, 19938, 20043, 20045, 20053, 20059, 20075, 20619, 20738, and 21527.

19776 (AED-CONF-75-103-002) TECHNICAL CUSTOMER SERVICE IN ASSEMBLY, REPAIR AND MAINTENANCE. Kern, M. (Mueller (C.H.F.) G.m.b.H., Hamburg (F.R. Germany)). 1975. 5p. (In German). INIS.

From symposium on practical experience with radiation protection control as specified in paragraph 4.1 of the x-ray ordinance; Braunschweig, F.R. Germany (15 Apr 1975).

5 figs.

The technical customer service is responsible for the final constructional stage of x-ray equipment. The various components of the equipment are assembled, and the functioning of the unit is tested. Special measures such as listing of type and serial numbers and arrangement of delivery documents ensure smooth performance testing by the health physicist. (GE)

19777 (CONF-720805-P1, pp 135-154) FUNDAMENTALS OF SENSITIVITY LIMITS IN LOW LEVEL COUNTING. Walford, G. V. (Simtec Industries, Montreal); Bilboy, W. B. 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Studies of environmental radiation and its origins usually involve the measurement of weak activities in sample volumes ranging from small to very large. The efficient design and application of counting equipment suitable for such measurements requires a detailed understanding of instrumental sensitivity in low level counting. This paper describes the derivation of a general expression for the quantitative determination of sensitivity limits in low level counting. It may be used to obtain improved performance from new or existing equipment, and it also facilitates the intercomparison of different counting systems. (auth)

19778 (CONF-720805-P1, pp 233-243) SELF-BALANCING SHONKA ELECTROMETER. Spokas, J. J. (Illinois Benedictine Coll., Lisle). 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston, Tex. (USA)).

The accurate and reliable measurement of low levels of radiation by means of an environmental ionization chamber is just one of many measurements which relies on the precision determination of extremely feeble electric currents. Currents in practical ionization chambers caused by natural background radiation are of the order of 10^{-14} amperes. One percent accuracy in the determination of these levels would necessitate, therefore, that spurious currents must be held to under 10^{-16} A. Such a minute current demands that an electrometer must be employed for accurate measurement. Shonka et al. (1964) described a new type of electrometer having a number of features particularly suited for use with ionization chambers. The original electrometer and the version that was commercially produced required manual operation and only allowed discrete readings. This paper is concerned with the further development of that electrometer which overcomes these major limitations. (auth)

19779 (CONF-720805-P2, pp 663-665) FEASIBILITY STUDY OF THE USE OF LEAD LOADED PLASTIC SCINTILLATOR IN AIRBORNE MINERAL PROSPECTING BY GAMMA RAY SPECTROSCOPY. Bland, C. J.; Schoenaich-Peters, R. (Univ. of Calgary, Alberta). 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

An unloaded plastic scintillator may be used for gamma ray spectroscopy if one is able to distinguish the energy of incident gamma rays by the Compton "edge" rather than by locating the photopeak as may be done when high Z inorganic scintillators are used. Due to the low Compton cross section, however, the volume of plastic scintillator required is large compared to a NaI crystal of comparable sensitivity. Despite this difficulty, a plastic scintillator offers distinct advantages, including relative cheapness, ease of fabrication into complex shapes, fast response, and ease of handling. (auth)

19780 (EFI-57(74)) MULTISECTION PROPORTIONAL COUNTER FOR TRANSITION SOFT X RADIATION INVESTIGATION. Belyakov, E. S.; Lorikyan, M. P.; Parlakyan, L. K.; Petrosyan, R. V.; Markaryan, K. Zh. (Erevanskij Fizicheskij Inst. (USSR)). 1974. 13p. (In Russian). INIS.

The construction and operating characteristics of the 12-section longitudinal proportional counter for studying soft x-ray transition radiation are described. This permits recording the number of photons in each event at the same time as the gamma spectra are studied. Tests with ^{241}Am showed that with the 13.8-keV line, different counters show a difference of 15 to 18%. The maximum amplitude of the scatter is 4% of the average value. The total energy dispersion of all 12 sections with a 90% Ar + 10% CH_4 mixture in the counter is ±8% at the 13.8-keV line. (tr-auth)

19781 (HEDL-TME-74-45, pp JCGS.1-JCGS.23) "CRITICAL REQUIREMENTS OF THE SSTR METHOD". Gold, R. Nov 1974.

In LMFBR reaction rate and dosimetry 9th progress report for period October 1973-May 1974. (Hanford Engineering Development Lab., Richland, Wash. (USA)).

19782 TOTAL ERROR IN THE DETECTION OF PENETRATING RADIATION WITH A SCINTILLATION COUNTER. Silyuk, V. F. Sov. J. Nondestr. Test.; 10: No. 6, 700-704(1974).

Translated from Defektoskopiya; 10: No. 6, 91-96(1974).

A method is proposed for calculating the principal components of the total error in the detection of penetrating radiation with a scintillation counter operating in the current mode. The limits of applicability of the accepted methods of selecting flaw detector parameters are considered. (auth)

19783 AROMATIC NITRILES AS SCINTILLATION SOLUTES. Velazquez, C.; Castrillon, J. (Univ. of Puerto Rico, Rio Piedras). Int. J. Appl. Radiat. Isot.; 26: No. 5, 237-242(May 1975).

Several aromatic nitriles were examined as scintillation solutes in comparison with the standard compounds PPO and TP. It is concluded that aromatic nitriles should be considered as a new family of liquid scintillators within which, by the proper selection of the parent compound and the introduction of the cyano group at a favorable position, new and better scintillators can be developed. In particular, it is shown that 4-cyanoterphenyl is an excellent primary solute with properties that represent and improvement over those of the parent compound TP; 4,4'-dicyanoterphenyl is also efficient, but has low solubility, and can only be used as the secondary solute. (auth)

19784 COLLIMATORS FOR A WHOLE-BODY-COUNTER TO STUDY RADIOISOTOPE DISTRIBUTIONS. Wicke, A.; Porstendoerfer, J. (Giessen Univ. (F. R. Germany). Strahlenzentrum). Strahlentherapie; 149: No. 4, 394-401(Apr 1975). (In German).

6 figs.; 1 tab.; 11 refs.

For the four 6 in. × 4 in. NaI/Tl-crystals of a whole-body-counter several collimators were developed to perform not only counting but also localization. In respect to their good response, a 19-hole-collimator and several slit-collimators were designed. The geometrical dimensions were chosen in such a way that in a profile-scan one can distinguish between the right and the left side of the body. The physical characteristics, such as plane-source-response and spatial resolution especially at high γ-ray-energies were obtained by analysing line-source-functions. The results show that the advantages of using larger crystals are an increase of focal distance, higher sensitivity and adaptibility to high-energy-γ-ray-emitters. Therefore it is possible to decrease the body burden of the patients and to use radionuclides normally not applied in clinical routine scintigraphy. (auth)

19785 LEITFADEN DER TECHNIK DER NUKLEARMEDIZIN. (Introduction to Nuclear Medicine Measuring Techniques). Oberhausen, E.; Berberich, R.; Gloebel, B.; Austgen, M. (Universitaet des Saarlandes, Homburg/Saar (F. R. Germany). Abt. fuer Nuklearmedizin und Medizinische Physik); Kunkel, R. (Universitaet des Saarlandes, Homburg/Saar (F. R. Germany). Inst. fuer Biophysik). DAEV-Fach-Taschenbuecher fuer Lehre und Praxis. Loevenich/Koeln, F. R. Germany; Deutscher Aerzte-Verl. (1973). 216p. (In German).

83 figs.; 10 tabs.

The present booklet surveys the principles and measuring methods of atomic and nuclear physics as well as the application of radioactive materials in nuclear medicine. Different chapters deal with diagnostic techniques, therapy, in vitro tests and scintigraphy. (GE)

19786 EMPLOYMENT OF NOVEL SEMICONDUCTOR COMPONENTS FOR RADIATION MEASUREMENT IN ANALYTICAL MEASURING TECHNIQUES. Neff, H. (Siemens A. G., Karlsruhe (F. R. Germany). Systemtechnische Entwicklung). Arch. Tech. Mess. Messtech. Prax.; 463: No. 8, 124-129(1974). (In German).
11 figs.; 6 refs.

The article gives a short survey of the structure, sensitivity and energy resolution of Si(Li) detectors as well as their possible uses in chemical analytics. The advantages of the avalanche photodiode over photomultipliers for analytical purposes in the visible and the near infrared region of the spectrum are discussed. (auth)

19787 ALPHA-, BETA- UND ALPHA-BETA-KONTAMINATIONSMESSGERAETE UND -MONITOREN. Entwurf. (Alpha, Beta and Alpha-Beta Contamination Meters and Monitors. Draft). Berlin; Beuth (1974). 9p. (In German).
2 tabs.

The present proposed standard deals with sensitivity, accuracy, perturbation effects operating and mechanical properties and power supplies of surface contamination monitors. (GE)

19788 POLYMER NEUTRON DETECTORS CONTAINING SULFUR AND PHOSPHORUS. Ambardanishvili, T. S.; Kiknadze, G. I.; Kolomiitsev, M. A.; Levin, B. A.; Zakharina, T. Ya.; Dundua, V. Yu.; Pachuliya, N. V. Sov. At. Energy (Engl. Transl.); 37: No. 2, 862-864(Aug 1974).
Translated from At. Energ.; 37: No. 2, 162-163(Aug 1974).

The preparation and evaluation of homogeneous activation neutron detectors with a high specific content of sulfur and phosphorous is described. (2 figs., 8 refs.) (GHT)

19789 INFORMATION CAPACITY OF THE GAMMA CAMERA AS A TRANSMISSION CHANNEL. Schek, H. J.; Meder, H. G.; Ostertag, H.; Walch, G. (Deutsche Krebsforschungszentrum, Heidelberg). Nucl.-Med., Suppl.; No. 12, 21-24(1974). (In German).
From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

A computer program was developed for the calculation of the information transmission capacity of a gamma camera as a function of the sending intensity. The curves obtained using the energy distribution of ^{85}Sr are given for different dead times of the camera. An evaluation of the extent the dead time and the energy distribution affects the maximum information transmission showed that the dependence on the dead time is small. (JSR)

19790 QUANTITATIVE DOUBLE-DETECTOR SCINTIGRAPHY: OFF-LINE EVALUATION ON A PDP 11/20. Mueller-Schauenburg, W.; Feuchtinger, T.; Binzer, N.; Feine, U.; Epple, E.; Anger, K. (Univ., Tuebingen, Ger.). Nucl.-Med., Suppl.; No. 12, 29-32(1974). (In German).
From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

An intermediate report covering three aspects of quantitative double-detector scintigraphy is presented. The topics discussed are the specifications drawn up for quantitative scintigraphy, the construction of the medium-size computer used in the system, and the application of the computer constructed to the testing of the specifications developed. (JSR)

19791 INTRODUCTION OF A SMOOTHING FILTER IN SCINTIGRAPHY WITH SPECIAL CONSIDERATION OF THE REPEATED USE OF A FILTER. Jordan, K.; Schneider, B. (Medizinische Hochschule, Hanover). Nucl.-Med., Suppl.; No. 12, 33-38(1974). (In German).
From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The planned use of smoothing filters in scintigraphy assumes the presence of a number of various filter matrices in the computer. This limitation requires a corresponding computer capacity and is often unfulfilled in practice. A study was therefore made to determine the extent to which the number of necessary filter matrices can be reduced by multiple use of a filter on the same scintigram. The quantities of the filter factor which must be in linear distribution for the processing stage were also determined. (tr-auth)

19792 HYBRID EVALUATION METHOD FOR DIGITAL SCINTIGRAPHY: FILTERING AND STATISTICAL TEST. Wiebelt, H.; Walch, G. (Deutsche Krebsforschungszentrum, Heidelberg). Nucl.-Med., Suppl.; No. 12, 39-43(1974). (In German).
From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The development of a hybrid evaluation method for scintigrams is briefly outlined. With this method and by using a research apparatus of constant activity distribution with and without point source as the alternative hypotheses it is possible to state the probability that a point source of given intensity can be established over a constant background. Typical profiles at the site of a point source in unfiltered and filtered scintigrams are given as illustrations of the validity of using the combined filter and likelihood ratio test for the evaluation of scintigrams. (JSR)

19793 INTRODUCTION OF A COHERENT OPTICAL COMPUTER FOR AMPLIFYING DATA OF SCINTIGRAMS. Bofilias, I.; Kretschko, J.; Hoer, G.; Pabst, H. W.; Plantzer, H. (Technische Univ., Munich). Nucl.-Med., Suppl.; No. 12, 44-47(1974). (In German).
From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Some examples are given of scintigrams processed by a coherent optical computer in order to improve the information of the scintigram. These examples are arguments for the total integration of such computers in nuclear medicine, especially since they offer a series of additional filter possibilities. (tr-auth)

19794 EVALUATION OF FOCUSED COLLIMATOR PERFORMANCE. IV. Five-Inch Siemens Collimators. Tsialas, S. P.; Psarrakos, K. P.; Dimitriou, P. A.; Sgouridis, A. S. (Greek Atomic Energy Commission, Athens). Nucl.-Med., Suppl.; No. 12, 100-105(1974).
From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The performance of the moving and stationary scintigraphic equipment depends mainly on the geometrical and physical characteristics of the collimator-detector, which constitutes the data aquisition system. For the evaluation of the collimator performance and the intercomparison of scintigraphic instruments, a simple method has been established by the I. A. E. A. The measurement of the response of a collimator-detector system to a line source of activity, offers a simple way of presenting the physical specifications of the system, namely the plane source sensitivity, the spatial resolution and/or the MTF, and the septa penetration fraction. The LSF of the 5 inch Siemens collimators have been measured. Calculations for decay, normalization, MTF and septa penetration response were performed on a CDC-3600 computer. A summary of the results of the measurements made and a brief description of the equipment used are presented. (auth)

19795 GAMMA PROBE DRY BULK DENSITIES. Rawls, W. J. (Agricultural Research Service, Boise, Idaho); Brooks, R. H. Soil Sci.; 120: No. 1, 68-70(Jul 1975).

The gamma density probe is a useful instrument for measuring water content in small volumes of soil. Essentially, the gamma probe measures the density of the soil and water between a source and a detector. To transpose the gamma densities into water content, the dry bulk density of the soil is needed. A nondestructive method for estimating dry bulk densities for use with the gamma probe is proposed. The procedure is based on the assumption that water content values in a field dry condition were more stable than the dry bulk density values and could be transferred from one point to another. The procedure was successfully used on three areas in Reynolds Creek Experimental Watershed in southwest Idaho. (auth)

19796 INSTALLATION OF NEUTRON PROBE ACCESS TUBES IN STONY AND BOULDERY FOREST SOILS. Cline, R. G.; Jeffers, B. L. (Washington State Univ., Pullman). Soil Sci.; 120: No. 1, 71-72(Jul 1975).

A method for implanting neutron probe access tubes in inaccessible stony and bouldery soils is described. The method employs a steel rod to displace the soil after which an access tube is dropped into place. Use of a displacing device rather than a pneumatic drill appears to improve contact between access tubes and soil. This method is not preferable to removal of soil with a sampling tube-like device where possible. (auth)

19797 ELECTRIC PROPERTIES OF DEEP IMPLANTED SHEETS IN SILICON AND THEIR USE FOR THE DEVELOPMENT OF AN INTEGRATED SEMICONDUCTOR COUNTER TELESCOPE. Kostka, A. G. Heidelberg; Univ. Heidelberg (1973). 71p. (In German). INIS.
Thesis.

The present paper deals with deep implanted silicon sheets. For the production of these implants boron ions with energies in the MeV range were applied to silicon monocrystals. The most important results are: (1) The maximum electric yield is nearly 100%. The corresponding critical heating temperature is dose dependent and ranges from 650° to 900°C. (2) The depth distribution

of ions is characterized by a steep decrease to the inner regions of the crystal and smoother decreases to the surface. The position of the maxima agrees quite well with theoretical values. (3) The concentration of radiation damages is strongly dependent from the heating temperature. With moderate doses the crystal quality after heating at 650°C recovers to such an extent that spectroscopic demands are fulfilled. (GE)

Radiation Dosimeters

Refer also to abstract 19899.

19798 (AED-CONF-73-697-000, pp 139-150) DOSIMETRY WITH RADIOPHOTOLUMINESCENT GLASSES OF LOW ENERGY DEPENDENCE AND HIGH SENSITIVITY. Becker, M.; Kaes, H. H.; Mueller, U.; Pitt, E.; Scharmann, A. 1973. (In German).

From meeting of the Schutzkommission by the Bundesministerium des Innern; Goettingen, F.R. Germany (Jun 1973).

5 figs.; 1 tab.; 4 refs.

In Schutzkommission by the Bundesministerium des Innern. Papers presented at the meeting at Goettingen. (Bundesministerium des Innern, Bonn (F.R. Germany). Abt. Reaktorsicherheit und Strahlenschutz).

An RPL dosimeter is described in which fluorides were substituted for the phosphate portion of the glass (laboratory glass 70.4% mol; fluorides mainly LiF, $LiPO_3$ and $Al(PO_3)_3$). Evaluations are made by the pulse evaluation method with a N_2 laser. Characteristic features of the dosimeter include lower limit of sensitivity 1 mrad, upper limit of the linear measuring range 10^3 rad, γ energy dependence 2-3, detectable γ energy range 15 keV-3 MeV, fading <0.1%/month, unlimited storage before radiation, thermal stability up to 150°C, interim evaluation and repeated evaluation possible, and erasure of records at 300 to 400°C. (GE)

19799 (CONF-720805-P1, pp 305-315) THERMOLUMINESCENT DOSIMETER MEASUREMENTS OF PERTURBATIONS OF THE NATURAL RADIATION ENVIRONMENT. Burke, G. deP. (Health and Safety Lab., New York). 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Presently available thermoluminescent dosimetry (TLD) techniques permit the quantitative assessment of variations as small as a few mR per year in the environmental gamma radiation field. The procedures for obtaining this degree of accuracy and sensitivity were established for LiF and glass encapsulated CaF_2:Mn thermoluminescent dosimeters and these dosimeters were chosen for the studies reported because of their current commercial availability. Following laboratory testing, three separate programs were established to determine the effectiveness of these dosimeters for delineating perturbations, both natural and man-made, of the radiation environment. One program involves monitoring of natural environmental levels in residential areas and two involve monitoring near nuclear power plants. The results of these investigations demonstrate the capabilities of thermoluminescent dosimeters for making low-level radiation measurements with accuracy and precision sufficient for detecting both natural and man-made perturbations of the radiation environment. (auth)

19800 (RT/EL-(75)1) DIGITAL MEMORY FOR TELEVISION IMAGES. Paretti, C. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Jan 1975. 24p. (In Italian). Dep. NTIS (US Sales Only) $4.25.

A system employing closed-circuit TV camera and MOS memory has been developed to take image information and store it. The apparatus is made by two sections: analog filters and digital memory. Filters have been used to select low amplitude signals from high frequency and low frequency noise components. The memory is arranged to make a non-destroying overlap of the digital array; this facility is useful for microscope image projection to overcome depth of field limits for use in automatic nuclear emulsion scanners for personel radiation monitoring. (auth)

19801 LARGE RADIATION DOSIMETRY WITH PERSPEX. II. Kanazawa, T.; Ohnishi, T.; Hiraoka, E.; Furuta, J. Annu. Rep. Radiat. Center Osaka Prefect.; 15: 71-74(1974).

The effects of scattered radiation and differences in two batches for Perspex dosimeter are reported, which causes the difference among calibration curves. The effect of lead scatterer attached to the dosimeter was examined. Stopping effect of PMMA plate against the back scattering radiation from lead was also examined. It is found that all the scattered radiation can be stopped by PMMA plate of 3 mm in thickness. (auth)

19802 MICRODOSIMETRY AND THE MEASUREMENT OF 45 MeV BETATRON RADIATION. Kiviniitty, K.; Anttonen, H. (Oulu Univ. (Finland). Dept. of Radiotherapy). Strahlentherapie; 149: No. 4, 390-393(Apr 1975).

4 figs.; 4 refs.

Different radiation spectra of a 45 MeV betatron have been measured with a microdosimetric system. The possibilities of microdosimetry in biological research are discussed. (auth)

19803 MEASUREMENTS FOR ENERGY DEPENDENCE TESTS OF LiF TLD 100 USING A PTW—DR. PYCHLAU KG TL—EVALUATION DEVICE. Waesch, G. Muenster, Ger.; Univ. Muenster (1974). 60p. (In German). INIS.

Thesis.

The behaviour of 100 LiF TLD rods was tested in 4,150 maximum and region measurements with regard to the energy dependence of the TL reading and to proportionality between dose and reading. The regeneration process of 2 full hours recommended by Messrs. Pychlau KG was not sufficient for complete regeneration of the rods. A satisfactory dose proportionality in ^{60}Co γ-rays up to 1,000 R was recorded in maximum measurements after modification of the regeneration process into a first tempering of 35 minutes and a second tempering of 23 hours. (auth)

19804 DOSE PROPORTIONALITY MEASUREMENTS WITH A PTW-LIF THERMOLUMINESCENT DOSEMETER. Engberding, R. Muenster, Ger; Univ. Muenster (1973). 78p. (In German). INIS.

Thesis.

Some general studies of the relationship between measured values and dose rates are described. LiF-TLD-100 rods were used as thermoluminescent material. The LiF rods were irradiated with a ^{60}Co teletherapy unit. The evaluations indicated approximate proportionality between measured values and dose rates in the range between 100 and 1,000 R. There were deviations of up to 11% from the expected values. At 1,600 R, the measured values were about 20% higher than the expected values. The excessive linear increase of the measured values at dose rates of more than 1,000 R is for the most part due to the insufficient regenerative process. (GE)

19805 ABSOLUTE MEASUREMENT OF GAMMA-RAY LOW EXPOSURE RATE. Katoh, A.; Yamachi, I. (Electrotechnical Lab., Tanashi, Tokyo (Japan). Tanashi Branch). Denshi Gijutsu Sogo Kenkyusho Iho; 38: No. 6-7, 264-276(Aug 1974). (In Japanese).

An absolute measurement of exposure rate ranging from 1 to 500 mR/h was carried out with a graphite cylindrical ionization chamber for ^{60}Co, ^{137}Cs and Ra gamma-rays. The ionizing volume of the chamber was 63.4 cc and the wall thickness was 3 mm. The ionization current produced in the chamber was measured by a charge-up method using a vibrating reed electrometer, a standard air capacitor and a timer. The reproducibility of the current measurement was much affected by the humidity in the atmospheric air. The humidity effect was removed by covering the chamber with a thin vinyl bag with silica gel in it. The reproducibility of the current measurement was almost within ±0.3% for approx. 10^{-12} A (corresponding to approx. 200 mR/h). The gamma-ray attenuation at the chamber wall was determined by extrapolating the plot of the ionization current against the wall thickness to zero wall thickness. The correction coefficients for the attenuation were determined to be 1.023, 1.028 and 1.025 for ^{60}Co, ^{137}Cs and Ra gamma-rays respectively. The contribution of the scattered gamma-rays was determined by a method of shielding the direct gamma-rays incident to the chamber with a lead block. The correction coefficients for the contribution under such experimental conditions as those of the measurements were determined to be 0.985, 0.969 and 0.976 for ^{60}Co, ^{137}Cs and Ra gamma-rays respectively. The values of the mean mass stopping power ratio (wall material to air) were selected from the data in Table 1A7 in the NBS Handbook 85(1962), and the photon mass energy absorption coefficient ratio (air to wall material) from the LA-3753(1967). The exposure rates at 1 m from the source were measured against several sources of ^{60}Co, ^{137}Cs and Ra, and they were determined to be 83.2, 8.16 and 0.804 mR/h for 105, 10 and 1 mg of radium respectively. The total uncertainty in determining the exposure rate was estimated to be within ±1%. The results of the absolute measurement with Al and Cu chambers and a small volume graphite chamber were also given for comparison. (auth)

19806 AUTOMATIC MEASUREMENT OF IONIZATION CURRENTS. Nishimoto, A.; Kakui, Y.; Tonoike, M.; Takebayashi, M. (Electrotechnical Lab., Osaka (Japan). Osaka Branch). Denshi Gijutsu Sogo Kenkyusho Iho; 38: No. 8, 383-387(Sep 1974). (In Japanese).

An Equipment has been designed and constructed in order to carry out precise and automatic measurements of the ionization current in radiation dosimetry of X- or gamma-rays by means of the ionization chamber, the current to be measured ranging from 10^{-13} to 10^{-6} A according to the exposure rate and the volume of the chamber. It is capable of measuring the ionization current with

high accuracy by using the current integration method. The calculation of the exposure rate is transacted by an on-line system using an electronic calculator. The measurement and the data processing are carried out quickly and easily. The precision of this equipment is better than ±0.1% in the measuring range of 10^{-12} A. (auth)

19807 COMPARISON OF ACCIDENT DOSIMETRY SYSTEMS AT HPRR. Keirim-Markus, I. B.; Knyazev, V. A.; Kraitor, S. N. Sov. At. Energy (Engl. Transl.); 37: No. 4, 1097-1099(Oct 1974).

Translated from At. Energ. (USSR); 37: No. 4, 353-356(Oct 1974).

A roundrobin, international comparison of personnel accident dosimetry systems was carried out by specialists from 12 countries. The systems were irradiated during four pulses at 3 m from the center of the reactor core. Average and max errors were determined for neutron kerma and gamma dose; most of the errors are within the ±20% limit, with some deviations (60–120%). The least error in neutron kerma was obtained for the Hurst set of threshold detectors. The gamma dose was measured most accurately by USSR's TL and PL dosimeters, ORNL's dosimeters, and Yugoslavia's film dosimeters. (DLC)

Nuclear Spectroscopic Instrumentation

Refer also to abstract 19690.

19808 (AECL-5032, pp 52-53) EFFECT OF CRYOSTAT FAILURE ON HIGH-PURITY Ge DETECTORS. Gulick, M. A.; Malm, H. L. (Chalk River Nuclear Labs., Ont.). Jan 1975.

In Physics Division progress report, October 1 to December 31, 1974. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

19809 (CONF-720805-P2, pp 641-646) COMPUTER MODELLING AND EXPERIMENTAL CALIBRATION OF AIRBORNE GAMMA SPECTROMETER SYSTEMS. Adams, J. A. S. (Rice Univ., Houston, TX); Clark, R. B. 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

In the past ten years significant progress has been made in aerial gamma-ray spectrometer systems in regard to data gathering and reduction. Applications to a wide range of geological, environmental, and specialized problems are being made. Computer modeling can predict optimum survey conditions for given targets on the ground. Remaining problems include the accumulation of well documented case histories in various climates and terrains, better data processing and presentation, and above all better awareness on the part of end-users of both the capabilities and the limitations of this technique. (auth)

19810 (CONF-720805-P2, pp 649-662) GAMMA RAY SPECTROMETER FOR OPERATION IN SMALL AIRCRAFT. Fryer, G. E. (Rice Univ., Houston, TX). 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

A four channel gamma ray spectrometric survey system has been developed that is suitable for operation in small aircraft. The system is equipped with an 11½ in. dia, 4 in. thick NaI(Tl) detector. Previous work using a single channel instrument in a helicopter produced the criteria for the design of the present system. It was assumed at the outset that the helicopter would be the preferred vehicle. Weight, volume, portability, power consumption, facility of operation and versatility in data recording were the general design considerations. The construction proceeded in two phases. The spectrometer with analog data recording facility was completed first and the digital data recording subsystem was added in the second phase. The original intention to include analog spectrum stripping circuitry was abandoned with the addition of the digital recorder. (auth)

19811 (HEDL-TME-72-90, pp ANC.29-ANC.33) TESTS TO DETERMINE TIME VARIATIONS IN THE PEAK DETECTION EFFICIENCIES OF ND-3. Helmer, R. G.; Greenwood, R. C. Jun 1972.

In LMFBR reaction rate and dosimetry 4th quarterly progress report, March, April, May 1972. (Hanford Engineering Development Lab., Richland, Wash. (USA)).

19812 (IEA-359) AUTOMATED γ–γ ANGULAR CORRELATION SPECTROMETER. Saxena, R. N.; Monteiro, N. T. S.; Nuevo, A. B. Jr. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Oct 1974. 16p. (In Portuguese). Dep. NTIS (US Sales Only) $4.00.

An automated γ–γ angular correlation spectrometer is described in detail. Electronic arrangements used in integral and differential measurements have also been described. In part I there is a short theoretical introduction; the experimental arrangement is described in part II. The results of the directional correlation measurement of γ-cascades in ^{60}Ni and ^{75}As and of the lifetime measurement of excited states in ^{181}Ta and ^{81}Br are described in part III. (auth)

19813 (JUL-1162) ANALYSIS OF MOLECULAR MOTION WITH THE SV5-C NEUTRON SPECTROMETER AT THE FRJ-2. Stockmeyer, R. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Festkoerperforschung). Feb 1975. 52p. (In German). Dep. NTIS (US Sales Only) $5.75.

A neutron spectrometer has been developed having a multi-crystal monochromator and a multi-crystal analyser. The energy of scattered neutrons can also be analysed by the time-of-flight method. Examples are given for two of the various operation modes of this spectrometer, which demonstrate the good intensity to resolution ratio. The first is a measurement of the temperature dependence of the molecular reorientation rate in a plastic crystal, adamantane. The second is a study of the motion of hydrogen which is chemisorbed on a nickel catalyst. (16 figures, 55 references) (auth)

19814 (ORNL-5025, pp 120-122) ABSOLUTE CALIBRATION OF NEUTRON DETECTORS IN THE 10- TO 30-MeV RANGE. Fowler, J. L.; Cookson, C. A.; Schwartz, R. B.; Hussain, M.; Uttley, C. A. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

An experiment was conducted to determine the forward scattering of neutrons from protons at energies below 30 MeV. The associated particle method was used to determine the absolute efficiency of the neutron detector. The reaction chamber for absolute calibration is diagrammed. (SDF)

19815 COMPARISON OF COBALT-60 EXPOSURE DETERMINATIONS BY CALORIMETRY AND BY IONIZATION CHAMBER TECHNIQUES. Petree, B.; Humphreys, J. C.; Lamperti, P. J.; Loftus, T. P.; Weaver, J. T. (National Bureau of Standards, Washington, D. C. (USA)). Metrologia.; 11: No. 1, 11-15(Mar 1975).

2 figs.; 3 tabs.; 23 refs.

The exposure rate computed from calorimeter power measurements is compared to the exposure rate of the same source (1-Ci cobalt-60) determined by means of a graphite cavity ionization chamber. A difference of 0.38% was found and is not considered significant compared to the estimated systematic uncertainty (1.3%). (auth)

High Energy Physics Instrumentation

19816 (CEA-CONF-3089) ISOTOPIC SEPARATION AND THE PERFORMANCES OF A SLOWING DOWN ARRANGEMENT IN A BEAM OF HIGH ENERGY HEAVY NUCLEI. Cantin, M.; Goret, P.; Jorrand, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 1975. 6p. (CONF-750805-4). Dep. NTIS (US Sales Only) $4.00.

From 14th international cosmic ray conference; Munich, F. R. Germany (15 Aug 1975).

A setup of Cherenkov counters, sandwiching a thick lead absorber, was placed in a high-energy beam of oxygen and nitrogen nuclei. The velocity resolution of the individual Cherenkov counters in the presence of lead is compared to their resolution without lead. The influence of effects in the lead absorber — residual nuclear interactions, fluctuations on energy loss, Coulomb scattering — are evaluated in view of the possible use of a similar slowing down configuration for isotopic analysis of the primary cosmic ray nuclei. (5 figures) (auth)

19817 (DESY-L-Ueb-200) INVESTIGATION OF SPARK TRACK CONSERVATION AFTER DOUBLE-PULSED TRIGGERING WITH ALTERNATING PULSES. Avakyan, K. M.; Asatiani, T. L.; Ivanov, V. A.; Krishchyan, V. M.; Matevosyan, E. M. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F.R. Germany)). 1975. 5p. (In German). INIS.

2 figs.; 2 tabs.; 6 refs. Translation from Prib. Tekh. Eksp., no. 5 (1974) p. 43-45. Available from ZAED.

The parameters of tracks of charged particles are investigated for long delays in the wide gap spark chamber by means of double-pulsed triggering with high voltage HF pulses. It is shown that tracks with good spatial resolution can be obtained for the mixture Ne + Ar(0.6%) + SF_6 (5×10^{-2}%) at a delay of the Hs registering pulse of 0.25 to 1,000 μsec. (GE)

19818 (ITEF-81) OSCILLOGRAPH WITH THE OSK-2 LIGHT PENCIL. Afonyashin, Yu. A.; Danilova, R. A.; Zhurkin, V. V.; Zverev, G. E.; Kaspin, A. I.; Mileshin, V. A.; Mikhailov, O. E.; Polyakova, L. M. (Gosudarstvennyj Komitet po Ispol'zovaniyu

Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1973. 49p. (In Russian). INIS.

A description is given of a model variant of an oscillograph having a light pencil, which operates in conjunction with the computer "Razdan-3". The unit is distinguished by its compactness because of the wide use of integral microcircuits and special components. A description is presented of the program "OSK" for operating the unit. (SJR).

19819 (KFK-EXT-3/74-11) MEASUREMENT OF DETECTION EFFICIENCY OF A NEUTRON SPECTROMETER AND APPLICATION TO THE REACTION $\pi^- p \rightarrow \pi^0 n$ AND $\pi^- p \rightarrow \eta^0 n$. Stier, U. (Kernforschungszentrum Karlsruhe (F.R. Germany). Inst. fuer Experimentelle Kernphysik; Karlsruhe Univ. (TH) (F.R. Germany). Fakultaet fuer Physik). Feb 1975. 70p. (In German). INIS.

27 figs.; 3 tabs.; 47 refs.; with apps.

The charge-exchange reaction $\pi^- p \rightarrow \pi^0 n \rightarrow 2\gamma n$ (1) and $\pi^- p \rightarrow \eta^0 n \rightarrow 2\gamma n$ (2) are investigated in an experiment at 8 GeV/c incident pion momentum. The directions and energies of all participating particles are measured. The neutron could be determined by its time-of-flight and its interaction point in a large neutron spectrometer. Because of the energy dependence of the neutron detecting efficiency ϵ in plastic scintillators, the differential cross section of (1) and (2) are influenced by ϵ. In a special experiment $\epsilon = \epsilon(T)$ was determined with the reaction (1) at 660 MeV/c pion momentum. The differential cross sections of (1) and (2), corrected with ϵ, are compared with predictions of the Regge-pole model. (auth)

19820 (LPCTI-74-01) AUTOMATIC ANALYSIS CONTROL SYSTEM OF PHOTOGRAPHS. Dniestrowski, A. (College de France, 75- Paris. Lab. de Physique Atomique et Moleculaire; Paris-6 Univ., 75 (France)). 1974. 200p. (In French). INIS.

An interactive computer controlled CRT digitizer is being used for bubble chamber picture recognition. First the main features of the CRT digitizer are described, followed by a brief discussion of the computer choice. Then the software structure of the real-time multiprocessor system (CDC CYBER-72 operating under KRONOS-modified) is presented. The software appears to the user as a virtual computer named meta-machine, three topics are emphasised: the structure of the meta-procedure, i.e., its hardware, the meta-language used to control the operations and the debugging facilities. (FR)

19821 (RL-75/044) OBSERVATIONS AND MEASUREMENTS WITH DRIFT CHAMBERS AT THE RUTHERFORD LABORATORY. Bateman, J. E.; Connolly, J. F. (Science Research Council, Chilton (UK). Rutherford Lab.). Feb 1975. 34p. Dep. NTIS (US Sales Only) $4.75.

An account is given of the design and testing of drift chambers made at the Rutherford Laboratory. The performance of the graded cathode type was found to be particularly satisfactory and it is believed that this technique could be used to produce large area (~square metres) bidimensional detectors with attractive properties of spatial resolution and rate capability. (UK)

Radiometric Instruments

19822 (BM-RI-8038) PRECISION TESTS ON NEUTRON SULFUR METER IN COAL PREPARATION PLANT. Hall, A. W.; Martin, J. W.; Stewart, R. F.; Poston, A. M. (Bureau of Mines, Morgantown, W. Va. (USA). Morgantown Energy Research Center). 1975. 15p. Dep. NTIS $4.00.

A neutron meter was developed for monitoring the sulfur content of coal streams. Neutrons from 80 micrograms of californium-252 penetrate the coal, producing thermal neutrons that are captured by atoms of elements present in the coal. The excited atoms emit prompt gamma rays with energies characteristic of the capturing element. These gamma rays are detected with a 6- by 7-inch sodium iodide detector and processed by electronic equipment to produce a gamma ray energy spectrum of the elements. Tests of the meter at a commercial coal preparation plant showed that sulfur in moving coal can be determined to a precision of 0.05% sulfur within 2 minutes. Based on this report by the Bureau of Mines, reliability of the coal-handling system proved inadequate for long-term operation, however, and improvements are planned. (auth)

19823 AUTOMATIC X-RAY-RADIOMETRIC CHECKS ON THE ZIRCONIUM CONTENT OF INDUSTRIAL SOLUTIONS. Mordasov, V. P.; Massal'skaya, V. F. Ind. Lab.; 41: No. 1, 68-69(Jan 1975).

Translated from Zavod. Lab.; 41: No. 1, 51-52(Jan 1975).

During the execution of absorption x-ray-radiometric analysis with respect to the absorption jump for the metal being determined in the sample under investigation usually two beams of photons are transmitted alternately, arranged on different sides of the absorption edge of a certain element. It is possible to use the simplified method, irradiating the sample with one beam of photons. In this case one can substantially simplify the recording scheme and create the prerequisites for creating sensors of the substance composition in the automatic control circuits of industrial processes. In order to determine zirconium in industrial solutions, an instrument, whose block circuit is shown, was developed. Performance of the instrument is also given. (TFD)

19824 NUCLEAR LOGGING SYSTEM OBTAINS "BULK SAMPLES" FROM SMALL BOREHOLES. Seigel, H. O.; Nargolwalla, S. S. Eng. Min. J.; 176: No. 8, 101-103(Aug 1975).

A new nuclear logging technique, the "Metalog" system that makes bulk sampling possible using inexpensive, 6 in.-dia boreholes is described. Assays obtained with the system are representative of a cylinder of rock about 3 ft in dia. Among the metals responding well to the system are Cu, Ni, Fe, Cr, W, and Si. Several of the metals may be assayed simultaneously. The basic technique employed in the system is the neutron capture-prompt gamma process. The system uses a ^{252}Cf neutron source. (TFD)

19825 NONCONTACT TESTING OF THE CROSS SECTION OF A COPPER CONDUIT BY REFERENCE TO INDUCED ACTIVITY. Golikov, E. G.; Zol'nikov, P. P.; Sukhanova, K. A.; Vasnin, G. M. (Ural Polytechnic Inst., USSR). Sov. J. Nondestr. Test.; 10: No. 5, 551-554(1974).

Translated from Defektoskopiya; 10: No. 5, 63-66(1974).

A noncontact method of measuring the cross section of a copper conduit, based on determining the level of radiation arising from induced activity in the test conduit after irradiation of the latter with betatron bremsstrahlung, is studied experimentally. (auth)

19826 APPARATUS AND PROCESS FOR CONTINUOUS MEASUREMENT OF MOISTURE IN MOVING COAL BY NEUTRON THERMALIZATION. Stewart, R. F. (to Secretary of the Interior). US Patent 3,353,021. 14 Nov 1967. Filed 29 Sep 1964. 5p.

The invention relates to an apparatus and process for the measurement of moisture contents in solid materials. More particularly, the invention makes available a continuous moisture analysis of a moving mass of material, such as coal, by penetrating such material with neutrons emitted from a source of fast neutrons and detecting, counting, and recording slowed, or thermalized neutrons reflected from the internal structure of the material. (auth)

Radiation Effects on Instrument Components, Instruments, or Electronic Systems

19827 PERFORMANCE OF ADVANCED SILICON SOLAR CELLS IN A SPACE ENVIRONMENT. Opjorden, R. W.; Goldhammer, L. J.; Goodelle, G. S. (Hughes Aircraft Co., El Segundo, Calif. (USA). Space and Communications Group). pp 313-319 of Photovoltaic Power Generation. Cologne; Deutsche Gesellschaft fuer Luft- und Raumfahrt e.V. (1974).

From international conference on photovoltaic power generation; Hamburg, F. R. Germany (25 Sep 1974).

An advanced, high efficiency, silicon solar cell has been developed and extensively tested to determine the effects of exposure to a space environment. These cells, now available in production quantities, provide an average power of 69.1 mW for 2 × 2 cm sizes at 25°C - a 21 percent improvement in performance at beginning of life. This new type of silicon cell was exposed to a simulated orbit environment to determine the performance degradation that would be expected for an extended period of time; the environments simulated included electrons, high energy protons, low energy protons, and ultraviolet radiation. Cell performance was also measured during high altitude balloon flights for comparison with test values obtained during exposure to a xenon light source. (auth)

19828 ELECTRON AND PROTON IRRADIATION OF HIGH-EFFICIENCY SILICON SOLAR CELLS. Curtin, D. J.; Cool, R. W. (COMSAT Labs., Clarksburg, Md. (USA)). pp 321-335 of Photovoltaic Power Generation. Cologne; Deutsche Gesellschaft fuer Luft- und Raumfahrt e.V. (1974).

From international conference on photovoltaic power generation; Hamburg, F. R. Germany (25 Sep 1974).

High-efficiency silicon solar cells from two U. S. manufacturers were tested with electron and proton irradiation. They were compared to COMSAT Laboratories produced violet cells and conventional solar cells. The best new cells had initial power outputs comparable to those included in the published data on COMSAT produced cells. The high-efficiency cells degraded

faster than conventional 10-Ω-cm cells under electron irradiation. However, a comparison of unannealed cell data at 10^{15} electrons/cm^2 indicated that the 2-Ω-cm high-efficiency cells had a 27-% power advantage over conventional cells; the 10-Ω-cm high-efficiency cells retained a 15-% power margin. (auth)

19829 PHOTON DEGRADATION IN SILICON SOLAR CELLS - STATUS REPORT 1974. Crabb, R. L. (European Space Research and Technology Centre, Noordwijk (Netherlands)). pp 337-354 of Photovoltaic Power Generation. Cologne; Deutsche Gesellschaft fuer Luft- und Raumfahrt e.V. (1974).

From international conference on photovoltaic power generation; Hamburg, F. R. Germany (25 Sep 1974).

Following the discovery of the photon degradation phenomenon in irradiated silicon solar cells during 1972, several studies were undertaken to elucidate the degradation mechanism and the practical significance for solar array design. Results of intramural experimental work are presented together with results obtained from two extramural contracts. In January 1973, ESTEC placed a contract with Centre d'Etude Spatiale des Rayonnements, Toulouse, France, to characterize effective recombination levels. The diagnostic experiments are based on studies of minority carrier lifetime variations with injection level using a pulsed neodymium laser, coupled with isochronal annealing experiments. A second contract was placed at the same time with Departement d'Etudes et de Recherches en Technologie Spatiale, Toulouse, France, for the simultaneous photon and 1 MeV electron irradiation of CZ and FZ silicon solar cells. The results of both contracts are presented. The laboratory measurements are compared with spaceflight results for the solar array performances of the ESRO spacecraft HEOS A1, HEOS A2, ESRO II and ESRO IV, together with data from the UK spacecraft PROSPERO; all satellites, with the exception of ESRO IV, employed solar cells susceptible to photon degradation. (auth)

19830 INHOMOGENEOUS DEGRADATION IN SILICON SOLAR CELLS. Mottet, S.; Bernard, J. (Toulouse-3 Univ., 31 (France). Dept. d'Etudes et de Recherches en Technologie Spatiale); Schuttler, R. (Institut National des Sciences Appliquees (INSA), 31 - Toulouse (France)). pp 355-367 of Photovoltaic Power Generation. Cologne; Deutsche Gesellschaft fuer Luft-und Raumfahrt e.V. (1974).

From international conference on photovoltaic power generation; Hamburg, F. R. Germany (25 Sep 1974).

A physical model of simulation of damage caused by low-energy protons has been set-up. Results of calculations are compared with experimental ones. Values of the energy range relationship have been deduced. It is shown that for fluences sufficiently high to produce an appreciable degradation, the density of the recombination center is proportional to the square root of the fluence. (auth)

19831 SOLAR CELL EXPERIMENTS ON THE TIMATION III SATELLITE. Statler, R. L. (Naval Research Lab., Washington, D. C. (USA)); Treble, F. C. (Royal Aircraft Establishment, Farnborough (UK)). pp 369-377 of Photovoltaic Power Generation. Cologne; Deutsche Gesellschaft fuer Luft- und Raumfahrt e.V. (1974).

From international conference on photovoltaic power generation; Hamburg, F. R. Germany (25 Sep 1974).

Twelve solar cell experiments were on the Naval Research Laboratory TIMATION III (NTS-1) satellite launched on 14 July 1974, into a 13,620 km circular orbit at an inclination of 125°. The experiment comprises: 2 ohm-cm n/p, lithium-diffused p/n, violet n/p, p^+ back surface field, and ultra-thin wrap-around contact cells. The short-circuit current of the experiments ranges from 2 to 12 percent higher in space than under solar simulators. During the 5 year life of the satellite, the experiments will be exposed to radiation equivalent to 2×10^{15} 1-MeV electron cm^{-2} and to nearly 5,500 thermal cycles. (orig.)

Miscellaneous Instruments

Refer also to abstracts 19674, 20355, 20624, 20659, 20859, 21342, and 21508.

19832 (ORNL-TM-3901) BLOOD CELL SEPARATOR DEVELOPMENT FOR IN VIVO LEUKAPHERESIS: A CRITICAL ANALYSIS. Breillatt, J. P.; Remenyik, C.; Sartory, W. K. (Oak Ridge National Lab., Tenn. (USA)). Oct 1972. 141p. Dep. NTIS $10.25.

A review of granulocyte isolation methods concludes that leukoadhesion separators and centrifugal separators using differential sedimentation of granulocytes and red cell rouleaux offer the greatest probability of yielding a successful in vivo leukapheresis device. The production of an acceptable leukoadhesion separation method will require manipulation of biochemical cell control mechanisms. A preliminary hypothesis of cell control and adhesion was formulated, and includes repair of cells damaged by release from a substratum. A theoretical model of blood cell sedimentation is developed based on particle-fluid mechanics. Using this model, the NCI-IBM and Abcor centrifugal blood cell separators are analyzed and the causes of their inefficiency identified. Multiple staging can increase the granulocyte yield from centrifugal separators. Cell separators operating on the elutriation principle offer separation efficiencies beyond that theoretically possible with simple sedimentation. The flow-interaction separator uses an axially flowing stream to transport blood through a series of elutriation stages within a single rotor. (HLW)

19833 (ORNL-TM-3937) SEARCH FOR ERRATIC RESISTANCE CHANGES IN INDUSTRIAL DUAL-ELEMENT PLATINUM RESISTANCE THERMOMETERS HEATED FROM 0 TO 850°C. Hubbel, H. H. Jr.; Carr, K. R. (Oak Ridge National Lab., Tenn. (USA)). Jul 1975. Contract W-7405-eng-26. 14p. AT.

The resistance-temperature relationships of the two elements in five commercial, dual-element platinum resistance thermometers were compared over a range from 0 to 850°C. The two elements in a dual-element unit were connected as two adjacent arms of a symmetrical Wheatstone bridge, and the bridge was fed by a constant current source to give nearly constant sensitivity to resistance changes. The unbalanced voltage across the bridge, as the thermometer was heated and cooled, was recorded as a function of temperature to indicate changes in the difference in resistance between the two elements of a thermometer unit. Each thermometer was heated three or four times from 24 to 850°C, held at the high temperature for times of a few minutes to several hours, and then allowed to cool to near room temperature in about 2 hr. No large or abrupt changes in element resistance were observed with changes in time or temperature, nor were there any differences in resistance between the elements of a dual-element unit larger than 0.08 Ω (0.24°C). The differences in resistance were less than half as large during the second and subsequent heatings as during the first heating. The ice-point resistances, initially 100.0 Ω, increased as much as 0.28 Ω (0.84°C) after the first heating, but did not change more than 0.04 Ω (0.12°C) after subsequent heatings. These tests did not indicate any problems in the dual elements that might interfere with their satisfactory use in the coolant loops of Liquid Metal Fast Breeder Reactors, but many other tests will be needed to assure their suitability for this service. (auth)

19834 (ORNL-tr-2998) EVALUATION AND THERMAL SHOCK TEST OF WELDABLE STRAIN GAGE IN HOT SODIUM ENVIRONMENT (560°C). Yasuda, T.; Tomioka, Y. Translated by H. Kubota from Hihakai Kensa; 23: No. 8, 433-439(1974). 16p. Dep. NTIS $4.00.

The weldable type high temperature strain gage (product of Alitech Company, USA) was tested under conditions that simulated the thermal shock that would be present when the gage was mounted on the tube plate section of an intermediate heat exchanger. (TFD)

19835 (RDT-C-5-1T(3-75)) INDUCTIVE LEVEL MEASUREMENT SENSOR FOR USE IN LIQUID METAL. (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). Mar 1975. 30p. RSO.

This standard is to be used as the basic document for the procurement of inductive liquid metal level measurement sensors. It is intended that this standard will be supplemented by additional requirements dictated by the specific application. The standard presents the requirements for the design, material selection, fabrication and examination of the sensor portion only of an inductive liquid metal level measurement system. With one exception, that of the portable differential transformer, "Tri-coil" sensor, it does not include the related readout or control equipment. (auth)

19836 (TID/SNA-1461) DESIGN OF A TEMPERATURE MEASURING SYSTEM WITH RESISTANCE TEMPERATURE TRANSMITTERS FOR SERVICE IN TITAN II STORABLE PROPELLANTS. Chandon, H. C. (Aerojet-General Corp., Sacramento, Calif. (USA)). 29 Mar 1963. 121p. Dep. NTIS $9.25.

The design, development, and operation of a resistance temperature transmitter to measure the temperature of noncryogenic propellants during operation of the YLR87-AJ-5 and YLR91-AJ-5 (Titan II) liquid rocket engines are described. (WHK)

19837 (UCID-16810) DISTORTION IN SIMULATED ALPHA AND FWHM MEASUREMENTS ON OS-40 OSCILLOSCOPES LINKED IN SERIES. Harper, T. L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 6 Jun 1975. Contract W-7405-Eng-48. 26p. Dep. NTIS $4.50.

When a prompt diagnostic signal of the type recorded in underground nuclear tests is fed into a chain of OS-40 amplifiers linked in series, it is not recorded exactly the same from one oscilloscope

to the next. This report describes a study in which a particular configuration of OS-40 oscilloscopes was used to record simulated alpha signals ranging from 2000 to more than 4000 mu sec^{-1} and pulses having a FWHM of approximately 10 nsec. Alpha values of less than or equal to 2000 mu sec^{-1} were recorded adequately by the stacked oscilloscopes, whereas for alpha values of 4000 mu sec^{-1} and greater, serious degradation in the data was observed on all but the first scope in the chain. Peak width studies seem to indicate some broadening in the recorded FWHM the farther one proceeds along the oscillator chain. (auth)

19838 NEW MASS SPECTROMETER FOR ISOTOPIC ANALYSIS. Atom (London); No. 224, 83-85(Jun 1975).

A new type of mass spectrometer is described, based on experience gained at the UK Atomic Weapons Research Establishment. The compact instrument possesses a number of novel features. The first of these instruments has been successfully commissioned at UKAEA Dounreay, and a second instrument is being installed at Harwell for the measurement of isotopic ratios in U and Pu, and for depletion factors in B and other materials. Design improvements relate to vacuum technology, sample handling, electronic design, and precision of analysis. A reduction of sample size is also achieved, so that the instrument need not be in a controlled area, when analyzing radioactive materials. A turret source is incorporated into which six samples can be loaded into a cylindrical pot and each sample can in turn be analyzed without breaking the vacuum. At the end of each batch the complete turret is removed and cleaned so as to avoid "memory" effects. The method for preparation of U and Pu samples is described. Separated ions are detected by a scintillation detector. Working pressures are 10^{-6} torr in the flight path and 10^{-7} torr in the source. (UK)

19839 PLANT MEASURING DEVICE FOR MONITORING HF AND/OR UF_6 IN GASES. Hanebeck, N. (to Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bensberg/Koeln (F. R. Germany)). German(FRG) Patent 2,339,328/A/. 13 Feb 1975. 9p. (In German).

2 figs.

The author claims a plant monitoring device for the detection of minor HF and/or UF_6 impurities in air which has been exhausted as residual gas in uranium enrichment gas ultracentrifuges. The reduced optical reflection of smooth surfaces after vapour condensation is used as measuring principle. The residual gas is conducted into a vessel with two metal mirrors that are inclined towards each other. One of these mirrors is cooled from outside with liquid air. The reduced reflection after vapour condensation at the cooled mirror is recorded by bridge-connected photodetectors across a differential intensifier. Calibration is possible by admission of gases with known composition. Light source and photodetectors are located outside the vessel because of the chemical aggressiveness of the vapours, and the optical-windows are made of polychlorethylene. (GE)

19840 ANALOGSPANNUNGSBEREICHE UND DIGITALPEGEL FUER NETZBETRIEBENE STRAHLUNGSMESSGERAETE. Entwurf. (Analogue Voltage Ranges and Logic Levels for Mains Operated Nuclear Instruments. Draft). Berlin; Beuth (1974). 2p. (In German). (DIN-44800).

3 tabs.

The standard applies to all electronic radiation measurement units, not only to detectors. It relates to the ranges and levels of the signals at the inputs and outputs of the units. It serves the purpose of matching the input and output signals of units working in the analog and the digital modes. The following parameters are fixed: (1) voltage ranges and maximum permissible output voltages for analog signals; (2) output impedances for analog circuits; (3) digital levels and load impedances for binary signals. The standard is identical with IEC Publication 323 (1st edition 1970). (auth)

19841 AUTOMATIC CONTROLLING SYSTEM FOR POSITRON ANNIHILATION EXPERIMENTS. Shiotani, N.; Nakatani, H. (Institute of Physical and Chemical Research, Tokyo (Japan)). Rikagaku Kenkyusho Hokoku; 50: No. 6, 228-245(Dec 1974). (In Japanese).

An electronic controlling system to be employed in experiments on angular distribution of two γ-rays resulting from annihilation of positrons in metals was designed and constructed. In the experiment a γ-ray detector is mounted on a carriage which is movable along a circular arc with its center at the specimen, and the number of the γ-rays is counted for a fixed time duration at various points on the arc as a function of the position. The measurement takes so much time and labor that an automatization of the procedure is desirable. The electronic system utilizes sequence control by TTL IC random logics. It can be divided into three blocks, i.e., a γ-ray measuring unit made of scalers and timers, an automatic data recorder, and a position controlling unit for the radiation detector. They are integrated into a whole automatic system. The most essential function of the system is to bring the detector successively to numbers of preset positions in the desired order. A reversible motor drives the carriage, and its position is detected by counting the number of pulse signals from a proximity switch located near the periphery of a wheel on the driving axis. A pinboard is used to program the sequence of detector positions. This rather inexpensive system functioned satisfactorily and was found to be very reliable without any trouble through a continuous run for more than one year since its completion. (auth)

19842 EVALUATION AND THERMAL SHOCK TEST OF WELDABLE STRAIN GAGE IN HOT SODIUM ENVIRONMENT. Yasuda, T.; Tomioka, Y. (Ishikawajima-Harima Heavy Industries Co. Ltd., Tokyo (Japan)). Hihakai Kensa; 23: No. 8, 433-439(Aug 1974). (In Japanese).

As for the strain gages endurable in the transient thermal stress measurement of the structures in a high temperature sodium environment, the weldable type is most suitable. Simulating the conditions under which weldable gages are attached to the tube plate of an intermediate heat exchanger, their performance in a sodium environment at high temperatures (up to 560°C) has been studied, and the result of measurements at the time of loading repeated thermal shock is reported. The following matters were revealed. (1) Repeated thermal stress measurement with weldable strain gages is possible for sodium temperatures up to 560°C. (2) The results of thermal stress measurements did not necessarily agree with those by computer calculation due to the difference in conditions. (3) The follow-up of the gages to rapid strain change due to thermal shock is satisfactory. (4) As for the insulation resistance of the gages, insulation decreases with temperature rise. (JA)

19843 THE CONTROL SYSTEM FOR A FOUR-AXIS TYPE GONIOMETER. Kubota, T.; Niimura, N.; Oyamada, M. (Tohoku Univ., Sendai (Japan). Lab. of Nuclear Science). Kakuriken Kenkyu Hokoku; 7: No. 1, 136-139(Jun 1974). (In Japanese).

A four-axis type goniometer has been constructed for the high-precision crystalline structure analysis by TOF neutron diffraction. Its control system is described. The goniometer control system consists of a control panel and a subcontroller, centering in a mini-computer. The control facilities are installed in a laboratory and a measuring room, and the two are connected with cables about 200 m long. In the latter, there are a mini-computer, a control panel, an angle display, and input/output typewriters (which are called main controller). In the former, there are manual switches and signal transmitting receiving circuits (which are the subcontroller), pulse motor-driving circuit, and an amplifier for the rotary encoder and power source. The signals from the counter for neutron-diffraction measurements are sent to an on-line data-accumulating unit through a time analyzer. (JA)

19844 PHOTOELECTRIC SPECTROPHOTOMETER AND ITS APPLICATION TO THE DETERMINATION OF STELLAR RADIAL VELOCITIES. Karsten, L. Groningen; Rijksuniversiteit (13 Jun 1975). 93p. Rijksuniversiteit, Groningen.

Thesis.

This thesis describes the definition, construction and application of an astronomical spectrophotometer. The definition of the instrument was guided by a number of performance goals which were derived from a general interest in problems of galactic structure, especially as indicated by the stars in the solar neighborhood. At the Kapteyn Observatory in Roden a prototype spectrophotometer was constructed for research into the possibilities of the method and the development of optimum instrumental parameters. No effort was made to define more accurate classification criteria, so it must remain uncertain whether the instrument can be adapted for optimum classification or not. Nevertheless, while specializing the system for radial velocity measurements, the possibility of spectral line photometry was kept in mind. (NL)

ISOTOPE AND RADIATION SOURCE TECHNOLOGY

Isotope Separation (Industrial)

Refer also to abstracts 19702 and 19839.

19845 (CONF-750210-) URANIUM ENRICHMENT CONFERENCE FOR FOREIGN CONTRACTORS, OAK RIDGE, TENNESSEE, FEBRUARY 28, 1975. (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Production and Materials Management; Energy Research and Development Administration, Oak Ridge, Tenn. (USA). Oak Ridge Operations Office; Union Carbide Corp., Oak Ridge, Tenn. (USA). Nuclear Div.). 1975. 87p. Dep. NTIS $5.45.

The conference was called to explain the Operating Plan for the ERDA Gaseous Diffusion Plants to the foreign contractors of ERDA enrichment services. An invitation to comment on the proposed plan was contained in a Federal Register Notice (40FR 1117) dated January 6, 1975. The information at the meeting was to provide detailed background to assist those persons wishing to respond to the Federal Register Notice. The conference was nearly identical to a previous conference given in Oak Ridge on February 13 and 14, 1975 and printed as CONF-750209. The previous conference was for domestic contractions. The papers presented include: Introduction; Union Carbide-Nuclear Division Operations; Operating Features of the Gaseous Diffusion Process Complex; Operational Planning; Operating Plan for the ERDA Gaseous Diffusion Plants; Working Inventory of Enriched Uranium; Possible Deviations in the Operating Plan; Variable Tails Assay Option; Spent Fuel Processing; and Uranium Feed Supply Outlook. (TFD)

19846 (KFK-2142) CONSEQUENCES AND COUNTERACTIONS IN CASE OF FAILURE OF A STAGE COMPRESSOR IN A SEPARATION NOZZLE CASCADE FOR ^{235}U-ENRICHMENT. Fritz, W.; Schaefer, R.; Schuette, R. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Kernverfahrenstechnik). May 1975. 59p. (In German). Dep. NTIS (US Sales Only) $6.00.

Thesis. Submitted by R. Schaefer to Karlsruhe Univ. (F. R. Germany).

The failure of a stage-compressor may considerably affect the operation of a separation nozzle cascade, if no counteractions are taken. The most vigorous consequence of this perturbation consists in a high UF_6 transport towards the top of the cascade, which would imply a reduction of the UF_6 content in the stages downstream of the point of failure and a rise in the pressures and UF_6 concentration in the upstream stages. Within a short time interval three compressors in the vicinity of the faulty compressor would exceed the surge limit for up to two minutes. Even if overload of the plant components could be tolerated, counteractions must be initiated, since the high UF_6 transport would quickly destroy the isotope gradient of the cascade and a substantial loss of separative work would result from uranium isotope remixing. It results from this study that the most advantageous counteraction consists in synchronized shutting down and bypassing the group of stages accommodating the faulty compressor. It is sufficient to shut down the compressors of the group within about 1 sec after the incident and to open either the bypass valves and/or the short-circuit valves of the group within 4 sec after the event. Minimum closing times are not imposed for closing the valves which separate the group from the rest of the cascade. (auth)

19847 (UCRL-76923) SEPARATION OF URANIUM ISOTOPES BY SELECTIVE PHOTOIONIZATION. Snavely, B. B.; Solarz, R. W.; Tuccio, S. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 27 May 1975. 9p. (CONF-750653-1). Dep. NTIS $4.00.

From 2nd laser spectroscopy conference; Megeve, France (23 Jun 1975).

Recent results of experiments on the laser photoseparation of U isotopes are reported. In the first series of experiments a two-step ionization process using a Xe laser to excite the atoms below the ionization level and then a Kr laser to ionize the atoms was described. Under the geometric conditions of the experiment and power of the Kr laser, enrichments between 2.5 and 3 percent were obtained in runs lasting 2 hrs. Calculations to describe the ion trajectories in the collector system reflected the two-band pattern observed on the Be collector plate. A system to study the photoionization process was assembled in which the U beam is excited to a desired energy level with a CW dye laser and an ultraviolet beam intercepts the excited U beam. An analysis of a photoionization spectrum obtained at a resolution of 8 A indicates that the peak cross section for transitions to autoionization states from the $^7M_7$ level is large enough to be used in large-scale U separation systems. An ionization value of 6.15 +- 0.2 eV was deduced for the ionization potential of the U atom. (JSR)

19848 PROCEDURE AND FACILITY FOR THE SEPARATION OF ISOTOPES. DeWitt, R.; Jepson, B. E.; Schwind, R. A. (To United States Atomic Energy Commission). German(FRG) Patent 2,401,119/A/. 18 Jul 1974. 15p. (In German).

1 fig.; 2 tabs.

A continuously operating system for the separation and enrichment of sulfur isotopes on the basis of the coupling of an electrodialysis apparatus with a chemical exchange system is described. SO_2 feed gas is brought to reaction with NaOH to form $NaHSO_3$ with a higher percentage of the heavier sulfur isotope, which then reacts with H_2SO_4 in an exchange column. In that reaction SO_2 enriched with respect to the heavier isotope is released and can be separated via a particular duct. The other reaction products are regenerated to the initial products NaOH and H_2SO_4 within the electrodialysis unit and fed back into the cycle so as to maintain a closed loop. (GE)

19849 PROCEDURE AND APPARATUS FOR SEPARATION OF GAS MIXTURES IN COMPONENTS WITH DIFFERENT MOLECULAR OR ATOMIC WEIGHTS. Wikdahl, N. A. L. Norwegian Patent 131,799/B/. 8 Jun 1971. 16p. (In Norwegian).

A method of separating gases in components of different molecular or atomic weight by means of a cyclone of maximum diameter 5 mm with inlet pressure between 5 and 1000 mm Hg is described. The cyclone has a conical form, either right or oblique, with either straight, concave or convex surface. The operating temperature should preferably be between −20 and 300°C. Where a number of separation stages is necessary the cyclones may be arranged in a double series cascade. The cyclones may be made of any material resistant to corrosion by the gases to be separated. (NO)

19850 NUMERICAL ANALYSIS OF SEPARATIVE POWER OF ISOTOPE CENTRIFUGES. I. Nakayama, W.; Torii, T. (Hitachi Ltd., Tsuchiura, Ibaraki (Japan). Mechanical Engineering Research Lab.). J. Nucl. Sci. Technol. (Tokyo); 11: No. 11, 495-504 (Nov 1974).

A numerical method was developed to calculate the distribution of concentration of $^{235}UF_6$ in the rotating cylinder of a centrifuge. Satisfactory convergence was obtained by employing the formulation of convective terms devised for the computation of high Reynolds number flow. The pressure diffusion term was linearized and approximated by a constant value, which significantly reduced the number of cases to be run on a computer. The results of numerical analysis for a centrifuge of counter-flow type are shown, and the effect brought upon the separative efficiency by changes in various parameters is discussed. The results of the present analysis are compared with those obtained from the existing theory, and the reasons for the discrepancy between the two results are explained. It is shown that the results of the numerical analysis agree well with the experimental data obtained previously by Beams et al. (auth)

19851 GAMMA SCANNING OF LARGE TOWERS. Fulham, M. J. (Ontario Hydro, Tiverton); Hulbert, V. G. Chem. Eng. Prog.; 71: No. 6, 73-77 (Jun 1975).

In the GS process for heavy water production, the gamma scanning technique can be used to detect tray damage without entering the tower, monitor the rate of hole blockage in sieve trays, and evaluate the effect of changes in weir weight. (auth)

Isotopic Power Sources

Refer also to abstracts 19531 and 20411.

19852 NEW RADIOISOTOPE-POWERED CARDIAC PACER. Purdy, D. L. (Coratomic, Inc., Indiana, PA); Magovern, G. J.; Smyth, N. P. D. J. Thorac. Cardiovasc. Surg.; 69: No. 1, 82-91 (Jan 1975).

A small lightweight nuclear pacer is described. The unit weighs 61 Gm and occupies a volume of 33 c.c. It is a standard, R-wave inhibited, demand pacer and has been shown to be insensitive to electromagnetic interference. The unit has met all United States and foreign Atomic Energy Commission (AEC) safety specification requirements, including mechanical shock, industrial fire, accidental crush, cremation, impact, and corrosion. Its calculated life is in excess of 20 years. Extensive dog testing has been completed and will be described in detail elsewhere. The United States AEC has been issued a license to conduct extensive clinical trials.

These began in October 1974 and will be the subject of a later report. (auth)

19853 ENERGY SOURCES FOR IMPLANTED PACEMAKERS. Tomchishen, S.; Goldman, B. (Toronto General Hospital). Can. Nurse; 70: No. 10, 27-30(Oct 1974).

A review of energy sources presently available for permanent pacemaker systems, including the recent application of nuclear power is presented. (auth)

19854 RAREFACTION PHENOMENA IN GAS AND ISOTOPE SEPARATIONS. Muntz, E. P. (Univ. of Southern California, Los Angeles); Hamel, B. B. pp B.1.1–B.1.10 of Rarefied Gas Dynamics. Vol. I. Becker, M. (ed.). Linder Hoehe, Ger.; DFVLR-Press (1974).

From 9th international symposium on rarefied gas dynamics; Gottingen, F. R. Germany (15 Jul 1974). See CONF-740743-P1.

A survey is presented of the role played in the separation of gases and gaseous isotopes by rarefied gas dynamics. The Chapman–Eskog processes and molecular processes are discussed. (15 refs. 3 figs.) (GHT)

19855 RADIOISOTOPICALLY HEATED THERMOELECTRIC GENERATOR WITH WELD BRAZED ELECTRICAL CONNECTIONS. Goslee, D. E.; Barr, H. N. (to Nuclear Battery Corp.). US Patent 3,874,935. 1 Apr 1975. Filed date 18 Oct 1971. 10p.

In a thermopile composed of a plurality of parallel-oriented, elongated, small cross section bismuth tellurium elements with insulation therebetween arrayed together to define a block having end surfaces in which are exposed the ends of each of the elements and the insulation therebetween with electrical interconnections between selected pairs of said elements to place all of said elements in series, and a pair of terminals for the thermopile, the improvement comprising said electrical interconnections being in the form of wires or straps bent over at their ends with the bent-over ends alloyed into said ends of said elements and with the straight central portions of the wires extending between the elements slightly raised above their end surfaces. (Official Gazette)

19856 MEMBER FOR CONDUCTING EXCESS HEAT AWAY FROM HEAT SOURCES. Cooke-Yarborough, E. H. (to United Kingdom Atomic Energy Authority). US Patent 3,894,911. 15 Jul 1975. Priority date 28 Feb 1973, United Kingdom of Great Britain and Northern Ireland. 6p.

Should a radioisotope-powered engine (e.g., a Stirling cycle engine for generating electricity) stop working for any reason, the radioisotope heat source will continue to generate heat. This will result in a rise in temperature which may cause overheating of and possible damage to the engine as well as to the heat source itself. The invention provides a support/location member for conducting excess heat from the heat source and which, in normal operation of the engine, will impede the conduction of heat away from the heat source and so reduce thermal losses. The member is of elongated form and comprises a stack of heat-conductive slugs disposed in a tube and in interspaced relationship along the axis of the tube. The tube supports the slugs in axial alignment. Means are provided for attaching an end one of the slugs to the heat source and means operable on overheating of said end one of the slugs are also provided whereby the slugs are able to move into heat-conducting contact with each other so as to conduct the excess heat away from said heat source. The slugs may be brazed to the tube whereby progressive overheating of the slugs along the stack results in an overheated slug being freed from attachment to the tube so as to allow the overheated slug to move along the stack and engage the next slug in line in heat-conducting contact. (auth)

Radiation Sources

19857 EXPERIENCES OBTAINED WITH EXPERIMENTAL RADIOISOTOPE DEVICES USED FOR CONTINUOUSLY MEASURING AND RECORDING THE ASH CONTENT OF COAL ON BELT CONVEYORS. Adam, L.; Elek, G. Banyasz. Kut. Intez. Kozlem.; 18: No. 2, 165-170(1974). (In Hungarian).

Several variants of an experimental device operating by the reflection of Sr/Y–90 beta radiation have been developed. Measuring stations, installed above a belt conveyor, have been designed which can be continuously and reliably operated. The simple measuring and recording devices and the simple method of measurement make use of an enclosed radiation source of only 160 microcuries whereby mine operation remains uninterrupted. No special personnel is required for operation. The equipment supplies information on belt conveyor operation and on the quality of the transported coal thereby permitting instant interference. (Hung. Techn. Abstr.)

Design and Fabrication

19858 PULSED NEUTRON SOURCE WELL LOGGING SYSTEM. Dillingham, M. E. (to Western Co. of North America). US Patent 3,885,160. 20 May 1975. Filed date 10 Sep 1973. 16p.

A pulsed neutron source with a chamber containing a plurality of alpha emitting strips and beryllium targets coaxially mounted is described. A pulsed source is provided by rotation of the target to on-off positions along with electromagnetic and magnetic devices for positive locking and rotation. (auth)

19859 IRRADIATION APPARATUS. Bosshard, E. (to Sulzer Bros. Ltd.). Canadian Patent 968,887. 3 Jun 1975. 8p.

The irradiation apparatus includes radiation sources, and radiation shielding surrounding the sources forming an irradiation chamber from which a water-filled well is sunk. The sources are carried by a support which is provided with retaining means for the sources and by means of which the sources can be moved between their irradiation position in the irradiation chamber and their inoperative position in the well. The support is table-like and extends substantially perpendicularly to its direction of movement. The retaining means are distributed over the support surface. (CA)

Industrial Uses

Refer also to abstracts 19330 and 21372.

19860 (DP-MS-75-34) CALIFORNIUM-252: STATUS AND PROSPECTS. Permar, P. H.; Karraker, D. G. (Du Pont de Nemours (E.I.) and Co., Aiken, S.C. (USA). Savannah River Lab.). Sep 1975. AT(07-2)-1. 12p. (CONF-750913-2). Dep. NTIS $4.00.

From 4th international transplutonium elements symposium; Baden–Baden, F.R. Germany (13 Sep 1975).

The development and present status of the practical applications of ^{252}Cf are reviewed. Future prospects for the applications in the period 1975 to 1980 are considered. (TFD)

19861 (IEA-27) APPLICATION OF RADIOISOTOPES IN THE PETROLEUM, GAS, AND PETROCHEMICAL INDUSTRIES. Part I. Logging of Petroleum Wells (Natural Gamma and Gamma–Gamma Logging). Castagnet, A. C.; Duarte, U.; Ohara, T.; Said, M.; Szulak, C. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Mar 1974. 64p. (In Portuguese). Dep. NTIS (US Sales Only) $6.25.

The general objectives of the oil well logging and the theory of operation, design and application of the probes for natural gamma and gamma–gamma logging are described. The natural gamma logging is mainly used to identify the lithology of the formations cut by the borehole and also constitutes an auxiliary means to distinguish productive strata, estimate the index of permeability in shaly formations, measure the bed thickness and finally to facilitate the interpretation and correction of other measurements. The objective of gamma–gamma logging is the continuous measuring and recording of the strata bulk density variations as a function of depth. This measurement, in turn, serves to calculate the formations porosity. Combined with other logs, it represents a good approach for studying zones of interest under adverse conditions concerning both, the borehole and type of reservoir. Some practical examples regarding the project and utilization of natural gamma and gamma–gamma logging probes are given. (auth)

19862 IRRADIATION PLANT FOR FLOWABLE MATERIAL. Bosshard, E. (to Sulzer Brothers Ltd.). US Patent 3,889,123. 10 Jun 1975. Priority date 16 Feb 1972, Switzerland. 8p.

The irradiation plant can be used to treat various flowable materials including effluent or sewage sludge. The plant contains a concrete vessel in which a partition is mounted to form two coaxial irradiation chambers through which the flowable material can be circulated by means of an impeller. The partition can be formed to house tubes of radiation sources and to provide a venturi-like member about the impeller. The operation of the impeller is reversed periodically to assure movement of both heavy and light particles in the flow. (auth)

19863 NUCLEAR METHODS OF AIR POLLUTION CONTROL. Kotrappa, P.; Dua, S. K.; Bhanti, D. P.; Sundarajan, A. R. (Bhabha Atomic Research Centre, Bombay). pp 21-86 of Proceedings of Seminar on Air Pollution Control Techniques, 11-12 September, 1973. Bombay; Central Labour Institute (1973).

From proceeding of seminar on air pollution control techniques; Bombay (11 Sep 1973).

With a view to assessing the feasibility of radioactive ionization in control of air pollution, an apparatus for an intake of aerosol feed, irradiation with ^{192}Ir, and collection of suspended particles by electrodes has been fabricated and studies have been carried

out on artificially produced aerosols, with and without dust loads, of methylene blue and ammonium chloride. Efficiency of removal of suspended particles has been found to vary directly with electric field strength and length of collection electrodes and inversely with flow velocity. Removal efficiency remains constant for radiation dose rates above a certain value and is not affected by dust loadings. As compared with the electrostatic air cleaning system based on corona discharge, the system based on radioactive ionization consumes less electrical power, produces very little ozone and collects both positively and negatively charged aerosols. The system may also be useful for removing gaseous pollutants from air. A plan to build a practical air cleaning system based on readily available radioactive waste material serving as beta sources is also mentioned. (INIS)

19864 BIBLIOGRAPHIEN ZUR KERNFORSCHUNG UND KERNTECHNIK. Sektion 5: Bremsstrahlung von Lebensmitteln. Nr. 14. (Bibliographies in Nuclear Science and Technology. Section 5: Irradiation of Foods. No. 14). Meunzer, R.; Delincee, H.; Ehlermann, D.; Gruenewald, T. (comps.). Leopoldshafen, F. R. Germany; Zentralstelle fuer Atomkernenergie-Dokumentation (1975). vp. (In German).

The present issue of the bibliographic series "Irradiation of Foods" contains documents especially from the years 1972-1974. To make it easier for the user, the bibliographic section is divided into subject categories. Cross references are provided. The content of the single document is reflected by index terms in English. The index section consists of conference, author, report number, corporation, and journal index. (GE)

19865 USE OF RADIATION-INDUCED POLYMERS IN CEMENT SLURRIES. Knight, B. L.; Rhudy, J. S.; Gogarty, W. B. (to ICI United States Inc.). US Patent 3,877,522. 15 Apr 1975. Filed date 6 Nov 1972. 10p.

Water loss from cement slurries is reduced by incorporating within a cement slurry a polymer obtained as a product of radiation-induced polymerization of acrylamide and/or methacrylamide and acrylic acid, methacrylic acid, and/or alkali metal salts thereof. The polymerization is preferably carried out in 10 to 60 percent aqueous monomer solution with gamma radiation. The aqueous monomer solution preferably contains 25 to 99 percent acrylamide and 75 to 1 percent sodium acrylate. The polymer can be present in concentration of about 0.001 to about 3.0 weight percent, based on the aqueous phase of the slurry. (auth)

19866 USE OF RADIATION-INDUCED POLYMERS AS TEMPORARY OR PERMANENT DIVERTING AGENT. Knight, B. L.; Rhudy, J. S.; Gogarty, W. B. (to ICI United States Inc.). US Patent 3,872,923. 25 Mar 1975. Filed date 6 Nov 1972. 12p.

Temporary or permanent permeability reduction or plugging of porous medium to the flow of fluids is effected by treating, preferably by injecting under pressure into the pores, the porous medium with an aqueous solution containing a water-soluble polymer obtained as a product of radiation-induced polymerization of acrylamide and/or methacrylamide and acrylic acid, methacrylic acid, and/or alkali metal salts thereof. The polymer has sufficient properties to effect substantial permeability reduction of the porous medium. The polymerization is preferably carried out in 10 to 60 percent aqueous monomer solution with gamma radiation. A mixture of monomers, before radiation preferably contain 25 to 99 percent acrylamide and 75 to 1 percent sodium acrylate. Permeability can be restored by subsequently treating the porous medium with a chemical to break down the polymer, e.g., hydrazine hypochlorite solution, strong mineral acids, or bases. (auth)

19867 CALIFORNIUM-252: NEUTRON SOURCE FOR INDUSTRY AND MEDICINE. Reinig, W. C.; Permer, P. H.; Cornman, W. R. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Proc. Jap. Conf. Radioisotop.; No. 11, 103-125(Aug 1974).

From 11th Japan conference on radioisotopes; Tokyo, Japan (13 Nov 1973).

Californium-252 is probably the most versatile neutron source yet developed because of its many possible forms and applications. Its outstanding features are the copious emission of neutrons from a physically small package (2.3×10^{12} n/(sec-g)), low heat generation, and a 2.64-y half-life. There is no technical limit to the strength of a ^{252}Cf source, and ^{252}Cf is an excellent compromise between the neutron output of existing isotopic neutron sources and low-power research reactors. ^{252}Cf is being considered and evaluated for many applications in industry and medicine by organizations in the United States, Japan, and other countries. This paper reviews the history, production, and availability of ^{252}Cf and its many potential uses. Applications in life sciences, education, chemical analysis, exploration for natural resources, industrial process control, neutron radiography, nondestructive inspection, and neutron flux enhancement are described. (auth)

19868 CURRENT AND FUTURE USES OF RADIATION SOURCES IN U.K. INDUSTRY. Stevenson, J.; Ansell, K. H. (Radiochemical Centre Ltd., Amersham (UK)). Proc. Jap. Conf. Radioisotop.; No. 11, 34-57(Aug 1974).

From 11th Japan conference on radioisotopes; Tokyo, Japan (13 Nov 1973).

Although the future extent of the use of radiation from radioisotopes for industrial purposes is quite difficult to predict, one can make some deductions and predictions from an examination of the past. By 1960 the use of sealed radiation sources containing the fission products ^{137}Cs, ^{90}Sr, ^{147}Pm, and ^{85}Kr and reactor-produced nuclides such as ^{60}Co, ^{192}Ir and ^{210}Po was already well established in the United Kingdom. The main applications were for radiography and for straightforward level, density and thickness gauging, mostly based on simple absorption processes. In 1962 sources containing ^{241}Am became commercially available and during the next decade the industrial use of radioisotope sources was firmly based on these eight nuclides. The low energy gamma radiation available from ^{241}Am promoted interest in new techniques and further applications for other low energy nuclides such as ^{238}Pu and ^{55}Fe. However, no really important new nuclide appeared on the scene for almost ten years, when ^{252}Cf became available. In spite of the lack of new nuclides during this decade, the industrial use of sealed sources grew steadily. Much of this growth was due to an increase in the amount of useful information which could be obtained, by improvements in measurement techniques. Most reviews of radioisotope applications in industry are based on classification by application, or by type of emitted radiation. Since these developments seem to be mainly in the field of instrumentation and measurement it seems appropriate to consider them in terms of the basic physical processes involved in the interaction of radiation with matter. Such a classification shows the current importance of techniques based on ionization, scattering, fluorescence, and activation, compared with the techniques based on simple absorption processes which dominated the industrial scene ten years ago. Important progress has been made in the fields of chemical analysis, coating thickness measurement, and smoke detection. The introduction of ^{252}Cf opens up the possibility of new industrial techniques, mostly in the field of activation analysis. In the future one can expect to see the use of radiation sources extended into a wider range of industrial processes as the possibilities opened up by recent developments are fully realized. (auth)

19869 IRRADIATION METHOD FOR EXHAUST GAS TREATMENT. Machi, S. (Japan Atomic Energy Research Inst., Takasaki, Gunma. Takasaki Radiation Chemistry Research Establishment). Kagaku Kojo; 18: No. 5, 31-33(May 1974). (In Japanese).

Irradiation method was first investigated for the purpose of removing SO_2 in exhaust gas. A new fact has been found that 80 to 90% of SO_2 in exhaust gas is removed by the irradiation by electron beams of ~3 mrad. However, the removal rate of pure SO_2 was rather slow, so that it was presumed that the other constituent in the exhaust gas gave an accelerating effect to the removal of SO_2. Accordingly the simultaneous removal of SO_2 and NO_x has become promising. Next, a continuous flow irradiation system has been manufactured, and the data for the effects of electron beam intensity (rad/sec), composition of exhaust gas, irradiation temperature and exhaust gas circulation have been obtained. In one example, the removal of 100% NO_x in 2 sec and 90% SO_2 in 9 sec has been achieved, when concentration had been 80 ppM NO_x and 600 to 900 ppM SO_2 each. It was found that removal rate was in proportion to dose-rate for NO_x and to 1.3th power of dose-rate for SO_2. Removal process and chemical structure of produced solids are still unknown. (JA)

19870 PROCESS FOR NONDESTRUCTIVELY TESTING WITH RADIOACTIVE GAS USING A CHILL SET SEALANT. Gibbons, C. B. (to Eastman Kodak Co.). US Patent 3,891,844. 24 Jun 1975. Filed date 9 Jan 1974. 14p.

An article surface is nondestructively tested for substantially invisible surface voids by absorbing a radioactive gas thereon. The adsorbed radioactive gas is disproportionately retained on those surfaces presented by the substantially invisible surface voids as compared to the remaining surfaces of the article contacted by the radioactive gas. The radiation released by the radioactive gas remaining adsorbed is used to identify the substantially invisible voids. To immobilize the radioactive gas adjacent or within the surface voids, a sealant composition is provided which is capable of being chill set. The temperatures of the article surface to be tested and the sealant composition are then related so that the article surface is at a temperature below the chill set temperature of the sealant composition and the sealant composition is at a temperature above its chill set temperature. The article portion to be tested is then coated with sealant composition to form a chill set coating thereon of substantially uniform thickness. (auth)

19871 HIGH ENERGY ELECTRON IRRADIATION OF FLOWABLE MATERIALS. Offermann, B. P. (to Licentia-Patent-Verwaltungs-GmbH). US Patent 3,891,855. 24 Jun 1975. Priority date 29 Nov 1972, F. R. Germany. 6p.

In order to efficiently irradiate a flowable material with high energy electrons, a hollow body is disposed in a container for the material and the material is caused to flow in the form of a thin layer across a surface of the body from or to the interior of the container while the material flowing across the body surface is irradiated. (auth)

19872 CONSTRUCTION OF RADIOACTIVE LIGHTNING ARRESTERS. Puget, E. F. (to Nuclear Iberica S.A.). US Patent 3,896,342. 22 Jul 1975. Priority date 7 Aug 1971, Spain. 6p.

A radioactive, ionizing lightning arrester, or conductor is provided with at least one brush attached to an anemometer type mechanism in such a way that the radioactive source of the arrester will be automatically cleaned as the wind blows. The arrester is provided with a discontinuous metal surface which is spaced apart from and surrounds the radioactive source, and which is further electrically insulated from the remainder of the device so that it acts as an accelerating anode. (auth)

19873 CRITICAL ANALYSIS OF THE ITALIAN LEGISLATION ON THE PEACEFUL USES OF NUCLEAR ENERGY, WITH REGARD TO THE USE OF RADIOISOTOPES IN INDUSTRY. Failla, L. (Catholic Univ., Rome). Energ. Nucl. (Milan); 22: No. 2, 85-88(Feb 1975). (In Italian).

The basic provisions of the Italian laws regulating the use of radioisotopes in industry are examined, and their aspects concerning the authorizative decentralization, with particular regard to radiometric devices, are discussed in detail, as well as the plurality of the relevant fulfilments required. After analyzing the practical consequences of the above provisions, also in light of the statistical use of radiometric devices in Italy, it is concluded that the criterion of decentralized authorization and release hinders the development of the considered field, without however giving greater assurances from the radioprotection point of view. It is suggested therefore that, in the frame of a desirable revision of the present legislation, the concept of the prototype of a radiometric device is introduced, and consequently the criterion of authorization at a central authority level for each type of mass-produced device is adopted. (auth)

LIFE SCIENCES

19874 (AED-CONF-73-697-000, pp 125-132e) EXPERIMENTAL INVESTIGATION ON THE SETTLING OF AUTOLOGOUS AND HOMOLOGOUS, RADIOACTIVELY LABELLED CARTILAGE AND SKIN TRANSPLANTS AFTER BURNS. Hettich, R. 1973. (In German).

From meeting of the Schutzkommission by the Bundesministerium des Innern; Goettingen, F.R. Germany (Jun 1973).

10 figs.; 4 refs.

In Schutzkommission by the Bundesministerium des Innern. Papers presented at the meeting at Goettingen. (Bundesministerium des Innern, Bonn (F.R. Germany). Abt. Reaktorsicherheit und Strahlenschutz).

The cell population of the host was studied by means of autoradiography. For fascia transplantation, the experimental material was timed to the protein synthesis of bone and fasciae by the period of labeling. With regard to labeling, there were three different types of donor material: The material was either transplanted immediately after one labeling or immediately after repeated labeling during several days, or some time after repeated labeling. The donor rabbits were given one or more injections of ^{3}H-tyrosine or ^{3}H-phenylalanine. The receiver animals were killed in regular intervals up to a period of 9 months after transplantation. At all stages of examination, there was an absolutely homogenous radioactive labeling which decreased continuously at a more or less rapid rate depending on the preoperative treatment. It was assumed that homologous cialite-labeled fascia transplants do not just serve as substitutes during the regeneration of the host's tissue but that the amino acids of the transplant are reutilized. (GE)

Radiation Effects on Biochemicals

Refer also to abstracts 19337 and 19339.

19875 (COO-3009-19) TECHNICAL PROGRESS REPORT, 1 OCT 1974-1 JUN 1975. Stein, G. (Hebrew Univ., Jerusalem (Israel). Dept. of Physical Chemistry). 1975. Contract E(11-1)-3009. 19p. Dep. NTIS $4.00.

Work during the period October 1st, 1974 to June 1st, 1975 is reviewed, together with brief references to work done during the preceding years of the contract. The topics include pulse radiolysis studies on enzyme proteins, in particular RNase; studies on redox enzymes, in particular cytochrome-c; and primary radiation damage in mammalian cells at the nucleoprotein level, using chromatin as the model substance. (CH)

19876 (NP-20480(P8), pp 129-132) LET EFFECTS ON PRODUCTION OF DNA SINGLE-STRAND BREAKS AND THEIR REPAIR IN E. COLI B/r. Igarashi, K.; Yatagai, F.; Takahashi, T.; Matsuyama, A. Dec 1974.

In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

19877 ENDONUCLEOLYTIC INCISION OF X-IRRADIATED DEOXYRIBONUCLEIC ACID BY EXTRACTS OF ESCHERICHIA COLI. Strniste, G. F.; Wallace, S. S. (City Univ. of New York, Bronx). Proc. Natl. Acad. Sci. U. S. A.; 72: No. 6, pp. 1997-2001(June 1975).

An endonuclease activity that reacts with x-irradiated DNA is present in extracts of E. coli. By using centrifugal methods to monitor the conversion of the supercoiled, circular double-stranded DNA for phage ϕX-174 (replicative form) or PM2 to the relaxed circular form it was possible to quantitate the rate of radiation induced endonuclease-sensitive sites in the DNA. For every single-strand break induced by x-rays under aerobic irradiation conditions, there is approximately one induced site sensitive to this endonuclease activity. Under irradiation conditions (addition of potassium iodide) that dramatically reduce rates of single-strand breaks and "alkalilabile" lesions, the number of endonuclease-sensitive sites relative to single-strand breaks increases approximately 4-fold. This nuclease is present in several strains of E. coli B and K12, including mutants deficient in DNA polymerase I, recombination gene products (rec mutants), ultraviolet light incision enzyme (uvrA mutant), and endonuclease II. It is suggested that this endonuclease may be involved in an excision repair process for damages incurred in DNA by ionizing radiation. (auth)

19878 APPLICATION OF PULSE RADIOLYSIS TO THE STUDY OF DRUG INTERACTIONS WITH BIOLOGICAL MACROMOLECULES. Greenstock, C. L.; Ruddock, G. W. (Atomic Energy of Canada Ltd., Pinawa, Manitoba). Biochim. Biophys. Acta; 383: No. 4, 464-467(2 Apr 1975).

19879 EFFECT OF GAMMA IRRADIATION ON EGYPTIAN SWEET POTATO STARCH. El Saadany, R. M. A. (Higher Agricultural Inst., Moshtohor (Egypt)); Abd El Fatah; El Safti, A.; El Saadany, F. M. (Ministry of Public Health, Cairo (Egypt). Nutrition Dept.). Staerke; 26: No. 6, 190-192(1974).

6 tabs.; 10 refs.

Sweet potatoes were sliced and dried under vacuo at 50°C. Following this, the potatoes were milled and the starch was separated and irradiated with 0.5, 0.75, and 1.0×10^6 rad of gamma rays. The samples were stored at room temperature up to 6 months. The following parameters were measured: pH value, acidity, reducing sugars, viscosity, solubility pattern, and water absorption. The results showed that treatment of sweet potato starch with different doses of gamma irradiation caused an increase in starch acidity and reducing sugars as well as molecular degradation as indicated by a marked decrease in viscosity and intrinsic viscosity and water absorption while the solubility increased. (GE)

19880 EXCISION OF PYRIMIDINE DIMERS BY SEVERAL UV-SENSITIVE MUTANTS OF S. POMBE. Birnboim, H. C. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Biology and Health Physics Div.); Nasim, A. (National Research Council of Canada, Ottawa, Ontario. Div. of Biological Sciences). Mol. Gen. Genet.; 136: No. 1, 1-8(Mar 1975).

1 fig.; 5 tabs.; 25 refs.

Nine radiation-sensitive mutants of S. pombe showing a variety of phenotypic characteristics were analyzed for their ability to excise pyrimidine dimers after ultraviolet irradiation. From earlier studies using indirect parameters, it was expected that some would be excision-deficient. Data reported here show that all the mutants tested, like wild type cells, were able to remove a high percentage of pyrimidine dimers during post-irradiation incubation in several different holding media, but not in saline or phosphate buffer. These mutants included strains showing increased, as well as others which showed decreased, levels of uv-induced mutation frequency relative to that of the wild type at the same total dose. (auth)

19881 MOLECULAR MECHANISM OF ACTION OF THE RADIOPROTECTIVE SUBSTANCE WR 2,721. Hahn, A.; Lohmann, W.; Hillerbrand, M.; Deffner, U. (Giessen Univ. (F. R. Germany). Inst. fuer Biophysik; Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (F. R. Germany). Abt. fuer Biophysikalische Chemie). Radiat. Environ. Biophys.; 11: No. 4, 265-269(Mar 1975).

3 figs.; 12 refs.

The radioprotective effect of WR 2,721 on catalase and the type and loci of its interaction with the enzyme have been investigated by means of spectrophotometric and electron spin resonance (ESR) methods. The radiation damage, indicated by a change in enzymatic activity and in the Soret absorption band, has been smaller with larger WR 2,721 concentration. In the case of ESR investigations, addition of WR 2,721 has resulted in a reduction of the spin concentration of Cu^{2+}. Since cysteamine has exhibited similar results, however, to a lesser extent, it can be assumed that the RS-ions are responsible for the protective effect. From the results obtained it can be concluded that (the dephosphorilized) WR 2,721 forms a complex with the enzyme and acts as an electron donor. (auth)

19882 DETERMINATION OF SH-GROUPS IN NATIVE AND IRRADIATED LACTATE DEHYDROGENASE. Mueller, E. Erlangen, Ger.; Univ. Erlangen-Nuernberg (1973). 75p. (In German). INIS.

Thesis.

LDH V was irradiated with x rays in aqueous solution under N_2. The SH determination proved that the irradiated enzyme undergoes fission with increasing dose and decreasing enzymatic activity. The irradiated enzyme was chromatographically separated. Radiation products of peak I showed some fission. The radiation products of peak III showed somewhat more fission than those of peak I. There is, however, no complete fission of the molecule. LDH V which with the addition of an organic substance (EDTA) was irradiated in the radiation buffer exhibited with the same irradiated dose, a smaller inactivation than LDH V irradiated without the addition of EDTA. The determination of the whole SH groups of native and irradiated LDH after folding up of the enzyme in 7 M urea showed a decrease of the cysteine with increasing dose. The investigations showed the complex molecular changes of the primary as well as of the tertiary structure in irradiated LDH. It is improbable according to the present results, that a single factor such as the destruction of cysteine is of outstanding significance in the radiation induced inactivation. (GE)

19883 ON THE ANTIBIOTICAL ACTIVITY OF GAMMA IRRADIATION PRODUCTS OF CHLORAMPHENICOL. Goto, R.; Tamemasa, O. (Shizuoka Coll. of Pharmacy (Japan)). Chem. Pharm. Bull. (Tokyo); 22: No. 10, 2352-2358(Oct 1974).

In order to develop a new molecular species of compounds with antibiotical activities by the application of radiation-chemical reaction, a study was made on the alterations of antibiotical activity of chloramphenicol after gamma irradiation of its aqueous solution. The results suggested that the gamma irradiation over 6.25×10^6 R of aqueous chloramphenicol solution resulted in the formation of new substance(s) that had an inhibitory activity on protein biosynthesis in Ehrlich ascites tumor cells, to the same extent as the activity of chloramphenicol before irradiation, although the antibacterial and protein biosynthesis-inhibiting actions on E. coli cells were markedly destroyed by irradiation. Furthermore, when chloramphenicol solution irradiated at a dose of 6.25×10^6 R was separated into five fractions by Sephadex G-10 gel filtration, some new substances, which were distinctly different from chloramphenicol in both Rf values on thin-layer chromatograms and antibiotical activities, appeared in the fractions 1, 4, and 5. However, the chemical nature of these products has not been characterized yet. (auth)

19884 REACTIVITIES OF ENZYMES TOWARD HYDROXYL RADICALS. Masuda, T.; Nakano, S.; Kondo, M. (Tokyo Metropolitan Univ. (Japan). Faculty of Science). J. Radiat. Res.; 15: No. 4, 171-175(Dec 1974).

Rate constants of enzyme proteins with hydroxyl radicals were estimated by summation of rate constants of amino acids toward hydroxyl radicals on the assumption that the radical reacts only with amino acid residues located on the surface of an enzyme molecule. Kinetic basis of the assumption was discussed in terms of reaction in solution. The calculated rate constants for lysozyme, cytochrome c, ribonuclease, and α-chymotrypsin were found to be consistent with the experimentally obtained ones. (auth)

19885 BIOLOGICAL AND MEDICAL STUDIES ON HEAVY ION EFFECTS. Matsuyama, A.; Takahashi, T.; Yatagai, F. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)). Nippon Genshiryoku Gakkaishi; 16: No. 4, 186-194(Apr 1974). (In Japanese).

A review is presented covering some recent studies on the biological and medical effects of bombardment with heavy ions, with particular reference to the breakage of DNA strands by heavy ions and to the dependence on LET shown by RBE and OER. The interaction between heavy ions and biological materials is briefly described, and a discussion is given of various aspects of the target theory published in the past with the aim of elucidating heavy-ion effects on biological systems. (auth)

19886 APPLICATION OF RADIATION CHEMISTRY TECHNIQUES TO ENZYME STUDIES. Badiello, R.; Tamba, M. (CNR, Bologna). Acta Vitaminol.; 28: No. 306-316(1974).

Studies, where radiation chemistry principles and techniques are being applied to investigate the functional groups of enzymes, are discussed. Steady state and pulse radiolysis techniques have been applied to the inactivation of yeast alcoholdehydrogenase (ADH). Inactivation of the enzyme was observed for OH radicals and H atoms. Some secondary radicals derived from OH [i.e. Br_2^-, I_2^-, and $(CNS)_2^-$] were found to lead to a larger inactivation. The sensitivity of ADH by the secondary radicals and the reactivity of these radicals with the enzyme and with the free amino acids are related. The role of -SH group of cysteine and the possible involvement of a histidine residue/or residues in the inactivation are discussed. (auth)

19887 USE OF THE PARAMAGNETIC LABEL METHOD FOR STUDYING THE CONFORMATIONAL CHANGES IN DNA ON ULTRAVIOLET IRRADIATION. Mil, E. M.; Zhil'tsova, V. M.; Kruglyakova, K. E. (Inst. of Chemical Physics, Moscow). Biofizika; 19: No. 4, 601-604(1974).

The authors have studied the kinetics of the conformational changes in the local-denatured regions of DNA molecules formed on exposure to ultraviolet radiation. It is shown that change in the parameter I_0 reflects the general process of degradation of DNA while change in the parameter τ_c reflects a conformational rearrangement in the local-denatured regions of the macromolecule. The character of the dependence of τ_c on the dose for three concentrations is apparently due to the different degrees of aggregation of the macromolecules. (auth)

Radiation Effects on Cells

Refer also to abstracts 19875 and 19898.

19888 (COO-3234-25) PHYSIOPATHOLOGY OF BLOOD PLATELETS AND DEVELOPMENT OF PLATELET SUBSTITUTES. Progress Report, August 1, 1974-July 31, 1975. Baldini, M. G. (Brown Univ., Providence, R. I. (USA)). 1975. Contract AT(11-1)-3234. 49p. Dep. NTIS $5.50.

Progress is reported on investigations of methods for the storage of human blood platelets. Good results were obtained when platelets were frozen using 5 percent dimethyl sulfoxide (DMSO) as a cryoprotective agent. There was no evidence of toxic effects of trace amounts of DMSO in experimental animals. Blood platelet storage at 22°C with nucleotide additives in the storage medium was also investigated. The effects of x irradiation at doses varying from 100 to 1000 R on the aggregation of blood platelets following exposure in vitro and the effect of Vitamin E as an antiaggregating agent were studied. (CH)

19889 (LBL-2874) ELECTRON MICROSCOPY AT REDUCED LEVELS OF IRRADIATION. Kuo, I. A. M. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). May 1975. Contract W-7405-ENG-48. 124p. Dep. NTIS $9.25.

Thesis.

Specimen damage by electron radiation is one of the factors that limits high resolution electron microscopy of biological specimens. A method was developed to record images of periodic objects at a reduced electron exposure in order to preserve high resolution structural detail. The resulting image would tend to be a statistically noisy one, as the electron exposure is reduced to lower and lower values. Reconstruction of a statistically defined image from such data is possible by spatial averaging of the electron signals from a large number of identical unit cells. (auth)

19890 RECOVERY OF COLONY FORMING ABILITY OF LETHALLY X-IRRADIATED L CELLS BY THE AID OF CELL FUSION. Megumi, T. Annu. Rep. Radiat. Center Osaka Prefect.; 15: 93-95(1974).

A million cells of L cells were fused with 10^6 cells of 8-azaguanine (8-AG) resistant L cells by the aid of UV-HVJ immediately after x irradiation with 3 kR to 20 kR which are lethal doses to L cells. In HAT medium, 8-AG resistant cells can not proliferate. The irradiated cells fused with 8-AG resistant cells were cultured in HAT medium. This condition selects the only fused cells to multiply. These fused cells could develop visible colonies 25 days after the fusion. Colony forming ability of the fused cells on the various days after x irradiation with 5 kR were examined 25 days after the fusion. Twenty-eight colonies were observed in L cells fused with 8-AG resistant cells 15 days after x irradiation with 5 kR. Several colonies appeared in L cells mixed with 8-AG resistant cells 15 days after irradiation with 5 kR without UV-HVJ. It shows that the lapse of days after x-ray exposure gives the similar effect as HVJ to cell membrane. (auth)

19891 EFFECT OF X-IRRADIATION ON ^{3}H-GLUCOSAMINE UPTAKE BY HUMAN EMBRYO FIBROBLASTS. Kubasova, T.; Varga, L.; Koeteles, G. J. (Orsazagos Frederic Joliot-Curie Sugarbiologiai es Sugaregeszsegugyi Kutato Intezet, Budapest). Int. J. Radiat. Biol.; 27: No. 4, 325-333(Apr 1975).

The incorporation of ^{3}H-glucosamine into unirradiated and x-irradiated (905 rad) cultures of human embryo fibroblasts was studied by light microscopic, autoradiographic, and biochemical methods in pulse-chase experiments. The precursor was ^{3}H-glucosamine. In unirradiated cells the grains appeared in various subcellular regions in a particular order: at first over the Golgi complex, then over the whole cytoplasm and finally at least some of the labelled macromolecules emerged from the cell. The radioactivity emerging from the cell appeared to be protein bound. Due to the effect of irradiation, the uptake of ^{3}H-glucosamine by the interphase cells was considerably decreased. The amount of radioactivity per cell indicated both the inhibition of cytoplasmic segregation and migration of labelled macromolecules from the cell. In the mitotic figures appearing after the release from radiation-induced mitotic block (approximately 30 hours after irradiation), the grain counts were still considerably lower than the controls. The functional and the structural radiation injury of the Golgi-complex was suggested by the less well-defined sequence of localization of radioactive macromolecules than in control cells. (auth)

19892 SURVIVAL OF CULTURED HARDING-PASSEY MELANOMA CELLS. Dewey, D. L. (Mount Vernon Hospital, Northwood, Eng.); Field, S. B. Int. J. Radiat. Biol.; 27: No. 3, 301-303 (Mar 1975).

Fast neutron irradiation of cultured Harding-Passey mouse melanoma cells gave a survival curve with an extrapolation number not distinguishable from 1, and a D_0 value of 42 rads. Irradiation with x rays gave a survival curve with an extrapolation number of 11 and a D_0 value of 92 rads. This extrapolation number for the x ray survival curve was lower than previously reported but still higher than for most types of mam-

malian cell. The significance for neutron therapy of the RBE value of 4 at a dose of 120 rads is discussed, although preliminary experiments with fractionated doses of neutrons showed that the surviving fraction increased by a factor of about three at 3 hours between fractions. Possible mechanisms of the unusual results for cells irradiated with split doses of neutrons under conditions where there was no shoulder on the survival curve are briefly discussed. (UK)

19893 CHEMICAL PROTECTION OF CULTURED MAMMALIAN CELLS AGAINST FAST NEUTRONS. Antoku, S. (Hiroshima Univ., Japan). Int. J. Radiat. Biol.; 27: No. 3, 287-292(Mar 1975).

Studies of chemical protection against fast neutrons may offer important information, both for neutron therapy and for elucidating the biological action of radiation. A study of the protective effects of sulphydryl compounds against 14 MeV neutrons and ^{60}Co γ rays for various cultured mammalian cells was carried out in an attempt to elucidate differing reports of their relative efficiencies against neutrons and x rays or γ rays in mammals or Artemia eggs. The survival curves of mouse leukemic cells and Burkitt lymphoma cells for these radiations showed significant reductions in protection by mercaptoethylamine (MEA) for neutrons compared with γ rays. There were no such changes in thiourea protection for neutrons and γ rays. Possible mechanisms for these radioprotective activities are discussed. Disagreement in the oxygen dependence and MEA protection of the radiation responses of Burkitt lymphoma cells between these results and other published data may be effected by the instability of this cell-line. (UK)

19894 HISTONE F1 PHOSPHORUS CONTENT AND DNA SYNTHESIS IN SLOWLY GROWING SUBLINES OF L5178Y-S CELLS. Szumiel, I.; Rosiek, G.; Beer, J. Z.; Budzicka, E.; Sablinski, J.; Kopec, M. (Inst. of Nuclear Research, Warsaw). Bull. Acad. Pol. Sci., Ser. Sci. Biol.; 21: 7-12(1973).

Slowly-growing sublines were isolated by cloning from x-irradiated cell populations of L5178Y-S cells. Phosphorus content of histone and ^{3}H-thymidine incorporation into DNA were determined for 7 such sublines with various mean doubling times. It was found that both histone phosphorylation and the ability to incorporate ^{3}H-thymidine into DNA were impaired in these sublines and that the degree of the impairment correlated with the proliferation rate. (auth)

Radiation Effects on Microorganisms

Refer also to abstracts 19876, 19879, 19880, and 19911.

19895 (AED-CONF-75-061-008) BIOLOGICAL EFFECTS OF HIGH ENERGY ELECTRON IRRADIATION OF MUNICIPAL SLUDGE. Sinskey, A. J.; Shah, D.; Merrill, E. W.; Sommer, S.; Trump, J. G.; Wright, K. A. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nutrition and Food Science). 1975. 21p. INIS.

From international symposium on the use of high-level radiation in waste treatment—Status and Prospects; Muenchen, F.R. Germany (17 Mar 1975).

7 figs.; 17 refs. With abstract. Available from ZAED.

Since May 1, 1974 studies at M.I.T. on electron irradiation of municipal waste water and sludge have been advanced by NSF support under RANN project GI-43112. All irradiations have been performed at the High Voltage Research Laboratory using a compressed gas-insulated 4 MeV Van de Graaff electron accelerator. This source was operated on simulated or actual sewage materials at 3 MV for most of the studies. The irradiated quantities per assay ranged from 20 to 1,000 ml and the dosages from 10^{4} rads to 3×10^{6} rads. The selection of doses depended on the sensitivity of the organisms and effects under study. Treatment times were mostly close to 1 second, the electron beam current being controlled to deliver the desired dosages in this time. Radiobiological measurements were first carried out on three typical water-borne bacteria and one bacteriophage. Conditions of irradiation were varied from the anoxic state to atmospheric air, atmospheric oxygen, and oxygen up to 15 atmospheres pressure. Later studies were made on coliform and total count reduction in municipal sludge. The studies showed that inactivation of bacteria and viruses in phosphate buffer and in sewage sludge can be obtained by electron irradiation. A dosage of 300,000 rads is sufficient to produce a 99.99% kill in the total population present in sewage sludge. The coliforms and other gram negative organisms in sludge proved to be the most susceptible to radiation. 100% inactivation of these bacteria was obtained with total dosages of less than 150,000 rads. (GE)

19896 (COO-2362-7) BASIC ASPECTS OF RADIATION ACTION ON MICROORGANISMS. Progress Report, April 1, 1974-March 31, 1975. Pollard, E. C. (Pennsylvania State Univ., University Park (USA). Dept. of Biophysics). Apr 1975. 39p. Dep. NTIS $5.00.

Progress is reported on the following research projects: effects of blocking DNA synthesis by hydroxyurea on induction of lambda phage; dose response curves for uv and ionizing radiation with radiosensitive and radioresistant strains of phage; effects of oxygen, rifampin, and hydrogen peroxide on induction of radioresistance; radioinduced degradation of DNA; and induction of repair system of mutagenesis with uv and ionizing radiation. (HLW)

19897 (NP-20480(P8), pp 126-128) INACTIVATION OF A RADIORESISTANT VEGETATIVE BACTERIUM MICROCOCCUS RADIODURANS BY CHARGED PARTICLES. Matsuyama, A.; Takahashi, T.; Yatagai, F. Dec 1974.

In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

19898 COMPARATIVE STUDIES OF HOST-CELL REACTIVATION, COLONY FORMING ABILITY, AND EXCISION REPAIR AFTER UV IRRADIATION OF XERODERMA PIGMENTOSUM, NORMAL HUMAN, AND SOME OTHER MAMMALIAN CELLS. Takabe, H. (Osaka Univ.); Nii, S.; Ishii, M. I.; Utsumi, H. Mutat. Res.; 26: No. 3, 383-390(Dec 1974).

The degree of survival of Herpes simplex virus after uv irradiation was high in African green monkey BSC-I cells, intermediate in normal human fibroblasts and human FL cells, and low in both xeroderma pigmentosum (XP) cells and mouse L cells. However, colony-forming ability after uv was high for FL, normal human fibroblasts and L cells, slightly low for BSC-I cells and extremely low for XP cells. During the 24-h post-uv incubation period, up to about 50% of the thymine-containing dimers in the acid-insoluble DNA fraction disappeared at an almost equal rate for BSC-I, FL, and normal human cells but remained unaltered for the XP cells. Alkaline sucrose gradient centrifugation of DNA after uv irradiation revealed only a slight difference between FL and BSC-I cells in the kinetics of formation of single-strand breaks and their apparent repair. From these and the previously known characters of L cells possessing reduced excision-repair ability it was concluded that if the survival of uv-irradiated Herpes simplex virus on a test line of human or other mammalian cells is as low as that on excisionless XP cells it is very probable that the test cell line is defective in excision repair. This reasoning lead to the presumptive conclusion that mouse L cells have an enhanced post-replication repair other than excision repair to deal with uv damage responsible for inactivation of colony-forming ability. (NL)

19899 RADIATION DOSIMETRY USING PHOTOGRAPHIC FILM. Tsujii, Y.; Ohnishi, T.; Hiraoka, E.; Furuta, J. Annu. Rep. Radiat. Center Osaka Prefect.; 15: 75-77(1974).

The measurements of irradiated dose for sprout inhibition of potatoes and onions are very important in the practical irradiation application. However, suitable dosemeters for this purpose are not available. The authors have tried to cover the dose range of sprout inhibition, 1 to 10 krad, with the use of photographic films available on the market. It is clear that Fuji Minicopy film HR can be used for the purpose, when it is developed for 9 minutes with Fujidol solution at 15°C. (auth)

19900 MUTAGENICITY TESTING OF IRRADIATED EXPERIMENTAL ANIMAL FOOD BY HOST-MEDIATED ASSAY WITH SALMONELLA TYPHIMURIUM G 46. Muenzner, R.; Renner, H. W. (Bundesforschungsanstalt fuer Lebensmittelfrischhaltung, Karlsruhe, Ger.). Int. J. Radiat. Biol.; 27: No. 4, 371-375(Apr 1975).

Food irradiated with 10 MeV-electrons (dose: 4·5 Mrad) was tested for mutagenic effects, using the host-mediated assay. Irradiated "Altromin" (a pelleted laboratory diet) was fed to mice for 9 to 44 days. After the 30th day of feeding, the animals additionally received irradiated glucose solution instead of drinking water. Results did not indicate any mutagenic activity of the irradiated diet on the histidine-auxotroph strain of Salmonella typhimurium used in the assay. (auth)

19901 CYTOGENETIC STUDIES IN RATS FED IRRADIATED WHEAT. Vijayalaxmi. (Indian Council of Medical Research, Hyderabad, India). Int. J. Radiat. Biol.; 27: No. 3, 283-285 (Mar 1975).

A comparison of the effects of feeding rats with freshly-irradiated wheat (less than 20 days after γ irradiation) and stored irradiated wheat (3 months storage at 4°C) showed that at the end of 12 weeks feeding there were no significant differences in the numbers of chromosomal aberrations in the bone-marrow cells of control rats and rats fed with the fresh or stored irradiated wheat. (UK)

19902 LINK BETWEEN STREPTOMYCIN AND RIFAMPICIN MUTATION. Chakrabarti, S. L.; Gorini, L. (Harvard Medical

School, Boston). Proc. Natl. Acad. Sci. U. S. A.; 72: No. 6, 2084-2087(Jun 1975).

Introduction of strA mutations frequently make "male" strains of Escherichia coli permissive to bacteriophage T7; certain rif mutations reverse the permissive effect of strA mutation. Permissiveness of the strA mutation is accompanied by enhanced transcription of bacteriophage T7 genome. Introduction of the nonpermissive rif allele to the permissive strA strain reduces or abolishes the transcription of T7 genome. Thus, a link is implied in the functioning of the ribosome and the RNA polymerase (RNA nucleotidyltransferase, EC 2.7.7.6). (auth)

19903 EFFECT OF GROWTH CONDITIONS DNA-MEMBRANE ATTACHMENT IN ESCHERICHIA COLI. Parker, D. L. (Univ. of Wisconsin, Oshkosh); Glaser, D. A. Proc. Natl. Acad. Sci. U. S. A.; 72: No. 6, 2446-2450(Jun 1975).

DNA-membrane attachment in cultures of E. coli B/r is found to depend on the pattern of DNA synthesis. When the number of replication points increases, the fraction of the DNA that is membrane bound also increases. The relationship between the amount of DNA-membrane attachment and the number of replication points is most consistent with attachment of all replication points and attachment of at least one other chromosomal site; it is inconsistent with attachment of the replication points only, the chromosomal origin only, or the chromosomal terminus only. When repair DNA synthesis is stimulated by irradiation with ultraviolet light, the DNA-membrane attachment remains unchanged. (auth)

19904 PHOTOREACTIVATION OF BACTERIOPHAGE PHIX 174. Mennigmann, H. D. (Univ., Frankfurt am Main). Int. J. Radiat. Biol.; 27: No. 4, 313-323(Apr 1975).

Ultraviolet-irradiated single-stranded DNA-bacteriophage ϕ X174 showed a photoreactivable sector of 0.17. That this sector was relatively small compared with those for the double-stranded DNA-phages T2 and T6 (about 0.5) did not necessarily seem to be due to the pyrimidine dimers in single-stranded DNA being intrinsically a poorer substrate for the photoreactivating enzyme. This followed from the observation that intracellularly irradiated single-stranded ϕ X174 DNA also showed a photoreactivable sector of 0.4 to 0.5. The same value was obtained for intracellularly irradiated double-stranded ϕ X174 DNA. Photoreactivation of intracellularly irradiated single-stranded ϕ X174 DNA was not constant with uv dose for the lower dose range. Possible explanations for this are discussed. (auth)

19905 RADIATION DAMAGE TO MEMBRANE-BOUND SULPHYDRYL GROUPS AND PERMEABILITY OF YEAST CELLS. Rink, H. (Bonn Univ., Ger.). Int. J. Radiat. Biol.; 27: No. 3, 305-310(Mar 1975).

Aqueous suspensions of fresh cells of bakers' yeast were either irradiated with 300 kV x rays (1800 rads/min) or treated with different concentrations of p-chloromercuribenzoate (p-CMB), and subsequently incubated for 4 hours in 0.05 % NaCl solution pH 7. Analysis for K^+-ion and Na^+-ion contents of the cells gave results showing exponential dose-response relationships for the loss of K^+-ions and for the uptake of Na^+-ions. Blocking the membrane-bound thiols by treatment with p-CMB resulted in similar alterations of electrolyte content as irradiation. The effects of the two treatments (irradiation and p-CMB) were additive at lower and non-additive at higher doses. An explanation is offered for this non-additive behavior. Determination of the decrease in membrane-bound sulphydryl groups after irradiation demonstrated that only 30 to 40% of the total amount of detectable sulphydryl groups disappeared after a dose of 500 krads x rays. An equilibrium between oxidation of sulphydryl groups to disulfides and splitting of disulfides by irradiation seems to be adjusted at higher doses. There was a distinct correlation between the loss of K^+-ions and the decrease in sulphydryls. The presence of glutathione (GSH) during irradiation resulted in some protective effect for alterations in electrolyte concentrations. Addition of GSH after irradiation gave a GSH concentration-dependent restituting effect, giving further evidence for the involvement of free thiols on or in the membrane with cation permeability. (UK)

19906 UNSTABLE STRAIN OF ASPERGILLUS FOETIDUS SEGREGATING PROLINE AUXOTROPHS. Chang, L. T.; Tuveson, R. W. (Miles Labs., Elkhart, Indiana). Appl. Microbiol.; 30: No. 1, 140-148(Jul 1975).

Two basic colony types have been obtained through single conidial isolation from the Bode strain of Aspergillus foetidus as well as from mutants of this unstable strain. Type I is prototrophic whereas type II is an auxotroph requiring proline. When a type I strain is grown on complex medium it gradually becomes overwhelmed by type II sectors of growth. However, essentially pure cultures of type I can be maintained on minimal medium (lacking proline). The yield of glucoamylase from type II cultures is less than half that obtained with type I cultures. The instability of type I cultures when grown on complex medium can not be explained by heterokaryosis or the presence of virus-like particles found in the original Bode strain and its derivatives. The isolation of five stable prototrophic strains obtained as more rapidly growing sectors from type I subcultures grown on complex medium suggests that the instability most probably results from a duplicated chromosomal segment or other chromosomal aberration analogous to those described in A. nidulans. (auth)

19907 EFFECT OF GAMMA-RAY TREATMENT OF SPIROCHETES OF THE BORRELIA ANSERINA (SAKHAROFF, 1891) SPECIES. Dzhankov, I.; Soumrov, I.; Stefanova, M. (Veterinary Inst., Stara Zagora, Bulgaria). Vet. Med. Nauki (Sofia); 10: No. 5, 25-30(1973). (In Bulgarian).

It was found that gamma-ray treatment of Borrelia anserina spirochetes brings about a graded drop in their virulence. Losing partly their virulence the spirochetes retain their immunogenic properties. The presence of spirochetes in the bird's organism leads in all cases to a certain change in the pattern of the immunologic response. This change is manifested with the release of agglutinins in the peripheral blood and the setting in of immunity at the 24th hour following the inoculation of irradiated spirochetes of the strain Sarnevo I of the same serotype, and at the 48th hour following the inoculation of irradiated spirochetes of the strain Rouen of the serotype Pamukchii. The duration of immunity is at least 120 days (up to the end of the experimental period). (auth)

19908 EFFECT OF RADIATION ON MICROBIOLOGIC CHARACTERISTICS OF M. TUBERCULOSIS. Zack, M. B.; Stottmeier, K.; Berg, G.; Kazemi, H. (Massachusetts General Hospital, Boston). Chest (Chicago); 66: No. 3, 240-243(Sep 1974).

The effect of irradiation on mutation (expressing itself as drug resistance) and on viability of Mycobacterium tuberculosis was studied in vitro. Forty-two identical cultures of H37-Rv (M. tuberculosis) were exposed to different levels of cobalt radiation (10, 100, 1,000, 2,500, 5,000, 10,000, and 20,000 rads) with six samples used for each of the seven radiation levels. Equivalent samples exposed to zero rads and samples handled and stored identically formed the controls. Coded cultures were read in a double-blind fashion to determine the number of surviving organisms and sensitivities to nine different antituberculosis drugs. Organism viability began to decrease at radiation levels of 1,000 rads and decreased linearly with higher levels of radiation. Three of the 42 radiated cultures developed drug-resistant organisms (one to INH, one to PAS, a third to SM). This drug resistance occurred at levels of clinical significance (greater than 1 percent control) as well as in amounts exceeding probability values for chance resistance mutation. High radiation levels such as occur in radiotherapeutic doses decrease the viability of M. tuberculosis. Radiation may also induce genetic mutation expressed as primary drug resistance. (auth)

Radiation Effects on Plants

19909 (COO-2283-5) RESPONSE OF A FOREST ECOTONE TO IONIZING RADIATION. Progress Report, 15 Oct 1974-14 Oct 1975. Murphy, P. G. (Michigan State Univ., East Lansing (USA). Dept. of Botany and Plant Pathology). 1975. Contract E(11-1)-2283. 5p. Dep. NTIS $4.00.

Compositional and structural characteristics of three forest types, including aspen dominated, maple-birch dominated and an intervening ecotone, were studied before and after chronic gamma irradiation in northern Wisconsin. Irradiation occurred during the summer of 1972. By the summer of 1973 the density of viable tree seedlings at 10 m from the radiation source was substantially reduced in all three areas relative to the preirradiation densities of 1971. Re-establishment of tree seedlings has, as of June 1975, been prevented by the vigorous development of ground vegetation. At 20 m, the density of seedlings in the three areas increased during the period between 1971 and 1973 in response to the partially opened canopy. The overall density of seedlings of Populus tremuloides and Acer rubrum increased markedly in the three areas and P. tremuloides invaded some areas in which it had not been found prior to irradiation. By 1974 many of the seedlings at 20 m had reached the sapling size-class. Viable trees greater than 2.5 cm, dbh were eliminated at 10 m in all three areas by June 1974 and were reduced in density of 20 m. Leaf litter production was reduced by up to 94 percent at 10 m and 64 percent at 20 m during the period between 1971 and 1973 in the irradiated areas. (auth)

19910 (COO-2283-6) RESPONSE OF A FOREST ECOTONE TO IONIZING RADIATION. Summary Report, 15 Oct 1972-14 Jul 1975. Murphy, P. G. (Michigan State Univ., East Lansing (USA). Dept. of Botany and Plant Pathology). 1975. Contract E(11-1)-2283. 26p. Dep. NTIS $4.50.

Compositional and structural characteristics of three forest types, including aspen dominated, maple-birch dominated, and an

intervening ecotone, were studied before and after chronic gamma irradiation in northern Wisconsin. Irradiation occurred during the summer of 1972. By the summer of 1973, the density of viable tree seedlings at 10 m from the radiation source was substantially reduced in all three areas relative to the preirradiation densities of 1971. Re-establishment of tree seedlings has thus far been prevented by the vigorous development of ground vegetation at 10 m. At 20 m, the density of seedlings in the three areas increased during the period between 1971 and 1973 in response to the partially opened canopy. Leaf litter production was reduced by up to 94 percent at 10 m and 64 percent at 20 m during the period between 1971 and 1973 in the irradiated areas. (auth)

19911 (INIS-mf-1790) APPLICATION OF ATOMIC ENERGY IN AGRICULTURE. Annual Report 1973. (Association Euratom-ITAL, Wageningen (Netherlands)). 1974. 160p. INIS.

This report contains a large number of contributions reporting results of research projects comprising studies on: primary (genetic) radiation effects on plants; other radiation effects on plants; mutation breeding of flowers for the trade; mutation research in potato; protein content improvement in pea, barley and opaque maize; mutation breeding for disease resistance in tomato, wheat, barley; irradiation in food preservations; genetic studies in plants; soil-plant relationships, i.e., behavior of different elements (a.o. heavy metals) and compounds in the plant and its soil environment as well as in water; and development of methods using radiation or radioactive isotopes in tracer technique. Practical applications of nuclear methods and techniques are surveyed. (INIS)

19912 RADIATION-INDUCED HIGHLY PRODUCTIVE MUTANT IN SORGHUM. Rao, E. V. V. B.; Reddi, V. R. (Andhra Univ., Waltair, India). Radiat. Bot.; 15: No. 1, 29-32 (Apr 1975).

The possibility of using radio-induced mutations for developing highly productive lines of Sorghum were examined. Mutant plants arising in the progeny of induced interchange heterozygotes of Sorghum variety I. S. 3566 grown from γ irradiated seeds were studied. The mutants were classified and considered under three different height classes of 2-Dwarf, 1-Dwarf, and 0-Dwarf. The 2-Dwarf (tall) plants were observed to produce more seed than the 3-Dwarf (short) controls. Other vegetative and panicle characters in the apparently true-breeding mutant were also affected, including increased numbers of leaves, nodes, and productive tillers. The mutant plant produced red grains on compact panicles of reduced length compared to chalky white grains on the semi-compact panicles of the untreated controls. An increase in grain weight of about 21% was shown in progenies studied through successive generations. The observed increase in yield could be traced to an increased number of grains produced on the main and tiller panicles. (auth)

19913 POTENTIAL OF GENETIC MANIPULATION IN PLANT CELL CULTURES FOR PLANT BREEDING. Bottino, P. J. (Maryland Univ., College Park). Radiat. Bot.; 15: No. 1, 1-16(Apr 1975).

In vitro culture of somatic cells of higher plants allows the plant breeder to apply the techniques of microbial genetics to specific breeding problems in crop plants. The basic techniques of callus and suspension culture, haploid plant culture from pollen, protoplast isolation, culture and fusion, and totipotency in plant cell cultures are reviewed. The genetical approaches which have application or potential application to plant breeding are also reviewed. These include selection of mutations in cell cultures, studying host-pathogen inter-relationships, transfer of genetic information into cells through uptake of native DNA, uptake of whole metaphase chromosomes or viral-induced transduction and interspecific hybridization through somatic cell fusion. The major difficulty to the application of many of these techniques to plant breeding programs is the inability to regenerate whole plants from somatic cells in some of the major crop plants. Some techniques such as mutant selection have been and are presently applicable in some crops, but others such as somatic cell fusion still require additional refinement before they will become generally applicable in a plant breeding situation. A survey is made of the present status of the culture methods possible in several important crop plants. (auth)

19914 COMPARISON OF GENETIC EFFECTS OF GAMMA-RAY IRRADIATION AND TREATMENTS OF CHEMICAL MUTAGENS IN A SIX-ROWED BARLEY. Yamashita, A.; Ukai, Y.; Yamaguchi, I. (Institute of Radiation Breeding, Omiya, Ibaraki (Japan)). Gamma Field Symp.; No. 11, 73-91(Mar 1974).

The mutation-inducing effect of chemical mutagens was compared with that of γ-ray irradiation by the use of a six-rowed, UZ type barley variety chikurin Ibaraki No. 1. Similar relationship between chlorophyll mutation ratio and dose of γ irradiation of seeds was observed throughout the experiment for 4 years from 1966 to 1971, and maximum chlorophyll mutation ratio per cell was less than 6%. Maximum chlorophyll mutation ratio by ethylenimine (ED treatment seemed to be 20 to 25% and maximum rates by nitrosomethyl urea (NMU) and ethylmethane sulfonate (EMS) were 30% and 28%, respectively. The relationship between mutation ratio and dose rate was linear in EI treatment, while the relationship with the latter two mutagens showed pronounced two hit pattern. The relative frequency of albina in total chlorophyll mutation was in order of γ-ray > EI $\fallingdotseq$ EMS > NMU. The mutants induced by γ-ray and chemical mutagens were classified to the following groups of drastic mutant type and analyzed; early mutants, gamete lethality including male sterility, semidwarf and dwarf, bright green mutants, virescent and stripe mutants, and rare morphological mutants. The results and the comparative consideration with the data on other varieties suggested that mutation ratio and the spectrum of field mutation depend on not only mutagenic agents but also largely on the genotype of the original variety. (JA)

19915 EFFECTS OF HEAT SHOCK TREATMENT ON THE RADIOSENSITIVITY OF RICE SEEDS. I. Survival Rate, Seedling Height, Root Length, and Seed Fertility. Itani, T. (Hiroshima Agricultural Coll., Saijo (Japan)); Yamagata, H. Hiroshima Nogyo Tanki Daigaku Kenkyu Hokoku; 5: No. 1, 53-57(Dec 1974). (In Japanese).

The present study was undertaken to analyze the protective effect of heat shock treatment on the radiosensitivity of rice seeds. The treatment was conducted for 2 minutes in hot water of 60°C immediately after x irradiation at −70°C, the effects of which were compared with those from x irradiation at room temperature in terms of LD_{50} or RD_{50}. It was demonstrated that this heat shock treatment remarkably enhanced the survival rate and markedly reduced the degree of radiation injuries as appeared in seedling height, root length, and seed fertility: LD_{50} or RD_{50} for these characters all being about twice as high as the case of treatment without a heat shock. (auth)

Radiation Effects on Animals

Man

Refer also to abstracts 19709, 19710, 19714, 19721, 19722, 19738, 19996, 20042, 20453, 21336, 21338, 21339, 21346, and 21369.

19916 (AED-CONF-74-494-004) RADIOBIOLOGICAL MODELS FOR TUMOR TREATMENT AND RADIATION DAMAGE IN CONSIDERATION OF THE SIZE OF THE TUMOR OR FOCUS. Busch, M.; Popp, F.; Rosenow, U. (Marburg Univ. (F.R. Germany). Radiologiezentrum). 1974. 1p. (In German). INIS.

From 5th scientific meeting of the Deutsche Gesellschaft fuer Medizinische Physik e.V.; Essen, F.R. Germany (8 Oct 1974).

When establishing models for tumor treatment and radiation damage to the tissue, consideration of the tumor or focus volume may help to understand important clinical findings. Therapy is more successful with decreasing tumor size, and the probability of radiation damage is diminishing with smaller focus volumes. With standard methods, lower radiation doses are required for smaller primary tumors. The therapeutical results are better for all primary tumor sizes when the focus size is adapted to the tumor size at a constant focal dose. The curative effect is also increased by a more homogenous dose distribution at the level of the tumor. The model shows that the patient's inherent immunity plays an important part in the healing of tumors. (GE)

19917 (AED-CONF-75-082-003) X-RAY APPLICATION IN DIAGNOSTICS AND THERAPEUTICS. Braun, H. (Wuerzburg Univ. (F.R. Germany). Roentgenabteilung). 1975. 18p. (In German). INIS.

From annual meeting of the Deutscher Verein fuer Versicherungswissenschaft e.V.; Karlsruhe, F.R. Germany (5 Mar 1975).

The lecture gives a general survey on the present possibilities of application of x rays and radioisotopes in medical diagnostics and therapeutics. The possibility of decreasing the radiation exposure by using image intensifiers and television is particularly indicated. The advantages of scintiscanning in diagnostics are presented by means of a series of examples. The increasing significance of telecurie equipment and particle accelerators are referred to in therapeutics. Finally, the radiation risk due to the medical application of radiation to the patient and the personnel is discussed and compared to the natural radiation exposure. (GE)

19918 (BNWL-SA-4813) DOSIMETRY OF THE RADIOACTIVE NOBLE GASES. Soldat, J. K.; Bramson, P. E.; Parker, H. M. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1973. Contract AT(45-1)-1830. 17p. (CONF-730915-17). Dep. NTIS $4.00.

From symposium on noble gases; Las Vegas, Nevada, USA (24 Sep 1973).

Methods are described that were used for estimations of the radiation dose rate to various human tissues from the radioactive gases of Ar, Kr, and Xe following inhalation or immersion in a

semi-infinite cloud. Dose rates to the whole-body, lungs, adipose tissues, and testes were calculated following inhalation and dose rates to the skin, whole-body, lungs, and testes from a semi-infinite cloud were calculated for ^{39}Ar, ^{41}Ar, ^{83}Kr, ^{85}Kr, ^{87}Kr, ^{88}Kr, ^{131}Xe, ^{133}Xe, ^{135}Xe, ^{137}Xe, ^{138}Xe, and also ^{88}Rb found in equilibrium with its parent ^{88}Kr and ^{138}Cs found in equilibrium with its parent ^{138}Xe. (CH)

19919 (CONF-720805-P1, pp 69-77) DIRECT MEASUREMENTS OF DOSE EQUIVALENT IN AIRCRAFT. Cowan, F. P.; Chester, J. D.; Kuehner, A. V.; Phillips, L. F. (Brookhaven National Lab., Upton, NY). 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Measurements were made of the radiation dose to passengers during air travel at various altitudes, geomagnetic latitude, and phase of the solar cycle in relation to travel time. Dosemeters and data computation methods used are described briefly. (CH)

19920 (CONF-720805-P1, pp 255-277) EXPERIMENTAL INVESTIGATIONS OF THE ENVIRONMENTAL RADIATION FIELD. Lowder, W. M.; Beck, H. L.; Raft, P. D.; Burke, G. deP.; Gogolak, C. V.; DeCampo, J. A.; McLaughlin, J. E. (Health and Safety Lab., New York). 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Several methods are described that were developed at the Health and Safety Laboratory that are representative of state-of-the-art techniques for the accurate assessment of human population exposure to the various natural and man-made components of ionizing radiation in the environment. The difficulties associated with such an assessment can be implicitly defined by considering various a priori analytical and instrumental requirements that are essential elements of successful methodologies. Among the most important such requirements are the following: the basic physical properties of the radiation field and its sources must be reasonably well-known to allow proper interpretation of instrument response; the radiation detectors must be sufficiently sensitive to provide statistically meaningful data, and operate reliably under a wide variety of field conditions as well as under the stresses associated with transport from site to site; and an individual measurement or set of measurements must either be directly interpretable in terms of radiation dose to persons and populations, or else be interpretable in terms of well-defined physical quantities that are useful inputs to analytical dose calculations. The design and performance of easily transportable ionization chambers and gamma-spectrometer systems are described. The substance of this paper is a description of how individual detector systems have been integrated into the program outlined above and of how the output data are interpreted dosimetrically, with illustrative results from various field surveys. (auth)

19921 (CONF-740598-1) OPTICAL VERSUS RADIOGRAPHIC MAGNIFICATION FOR FINE-DETAIL SKELETAL RADIOGRAPHY. Genant, H. K.; Doi, K.; Mall, J. C. (Franklin McLean Memorial Research Inst., Chicago, Ill. (USA)). 1974. 37p. Dep. NTIS $5.00.

From 22nd annual meeting of the Association of University Radiologists; New York, New York, USA (10 May 1974).

Fine-detail radiographic techniques for peripheral skeletal imaging have gained wide clinical acceptance. In this study, the imaging properties and clinical applications of the optical magnification technique, which employs fine-grain industrial film and a large focal spot, have been compared quantitatively and qualitatively with those of three slow screen-film techniques, namely, contact exposure with a large focal spot, 2× radiographic magnification with a 0.3 mm focal spot, and 4× radiographic magnification with a 50 μ focal spot. The modulation transfer functions (MTF's) of the recording systems and focal spots have been obtained and film sensitometry has been performed. Clinical comparisons for patients with metabolic, arthritic, and neoplastic skeletal disorders have been made. The results illustrate the superiority of the optical magnification technique over contact or 2× magnification techniques using slow screen-film systems. If a microfocus tube is used, however, direct radiographic magnification may provide images comparable in resolution, noise, and contrast to those made with the optical magnification technique, and at lower radiation exposure to the patient. (auth)

19922 (IFA-M-49-1974) ATLAS OF ISODOSE CHARTS FOR THE TELETHERAPY OF MALIGNANT TUMORS WITH Co-60. Cuzino, S.; Moldovan, N.; Zamfirescu, J.; Marghitu, V.; Rebigan, F.; Branescu, E.; Spiridon, M.; Szakats, M.; Matache, G.; Sandulescu, T. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 58p. (In Romanian). INIS.

In the first part of the Atlas a short review is made of the problems occurring in the field as these are stated in literature and a proper method for calculating of dose distribution is described. For the case of inclined incidence an original method is described which takes in account the correction factor for air-wedge introduced by oblicity. The experimental results are presented and they show a good agreement with calculations, maximum deviation being of 10 percent. In the Atlas some of 34 isodose charts are given based on a computer calculations, comprising a large variety of actual cases met in practice: (i) the normal incidence, (ii) the inclined incidence, and (iii) the crosswise multiple fields. In the Atlas the isodose charts for inclined incidence are given which are of great importance in teletherapy but little considered up to now. (auth)

19923 (SAAS-174) REPORT OF THE STATE MINISTRIES FOR ATOMIC SAFETY AND RADIATION PROTECTION OF THE GDR. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Dec 1974. 40p. (In German). Dep. NTIS (US Sales Only) $5.00.

Separate abstracts were prepared for the two papers presented in this report. (HLW)

For abstracts of individual papers see: 19924 and 19925.

19924 (SAAS-174, pp 3-27) EXAMINATION METHODS APPLIED BY MEDICAL SUPERVISORS OF RADIATION WORKERS. Schuettmann, W.; Arndt, D.; Jacobsohn, E.; Lenz, U. Dec 1974. (In German).

In report of the State Ministries for Atomic Safety and Radiation Protection of the GDR. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)).

On the basis of legal requirements medical supervision of occupationally exposed personnel is performed by the responsible medical officer according to an obligatory minimum program. If necessary, additional diagnostic methods are used. The obligatory program is described with particular emphasis on the anamnestic-clinical part. The additional methods are arranged into special groups, and in each case the most important indications are given for application. (auth)

19925 (SAAS-174, pp 29-40) DERMATOLOGICAL ASPECTS IN HANDLING UNSEALED RADIOACTIVE SOURCES WITH SPECIAL REGARD TO DECONTAMINATION. Lenz, U.; Schuettmann, W.; Arndt, D. Dec 1974. (In German).

In report of the State Ministries for Atomic Safety and Radiation Protection of the GDR. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)).

A survey of skin decontamination is given considering especially the occurrence of skin damages caused by commonly used decontamination agents and measures. Furthermore the dermatological fitness criteria for occupational handling of radioactive substances are described and possibilities for the treatment of fitness-influencing skin infections have been shown. (auth)

19926 CURRENT PERSPECTIVES ON RADIATION. Pental, L. (New York Univ., NY). N. Y. J. Dent.; 45: No. 3, 76-83(Mar 1975).

A popular account of the hazards of the dental use of x rays is presented. Some topics discussed are radioinduced chromosomal aberrations and mutations; delayed effects of radiation in producing tumors of the thyroid, parotid gland, and pituitary gland; radiation dose calculations; hazards of low energy generators; and the importance of using high speed film. (HLW)

19927 DOSE EQUIVALENT AND ABSORBED DOSE. Rindi, A.; Thomas, R. H. (California Univ., Berkeley). Phys. Med. Biol.; 20: No. 3, 491-493(May 1975).

The controversy over the term dose equivalent, its physical dimensions, and its units is discussed further. There seems to be general agreement that the physical dimensions of dose equivalent are the same as those of absorbed dose, i.e., energy per unit mass, L^2T^{-2}, and it is convenient to have units which are physically descriptive of the quantities they quantify. Any discussion of the quantity "dose equivalent" and its units should not fail to take into account its predecessor, the RBE dose. Consideration of the equations defining the RBE dose indicated that the units of RBE dose and absorbed dose are identical, although for clarity an RBE dose should be described as so many equivalent rads, equivalent joules kg^{-1}, etc., of standard radiation. The dose equivalent was introduced as the RBE dose for radiation protection and different terminology was used to signal to health physicists that in the absence of hard data the RBEs for radiation protection, had been administratively determined. The RBE dose and dose equivalent should therefore be identical physical quantities, and the unit rem is nothing but a shorthand way of writing "the equivalent dose of standard radiation in rad calculated for

radiation protection purposes". The unit rem should then have the magnitude (0·01/QN) J kg^{-1}, giving two units for the same quantity. This variation in magnitude of one unit is unfortunately inherent in the definition of dose equivalent. (UK)

19928 RADIOSENSITIVITY OF MESENCHYMAL TISSUE. Wiernik, G.; Perrins, D. (Churchhill Hospital, Oxford). Br. J. Radiol.; 48: No. 569, 382-389(May 1975).

A sheath of fibroblasts has been identified in the rectum and it may become possible to follow the cellular response to irradiation of this mesenchymal tissue. The numbers and the distribution of the pericryptal fibroblasts in normal human rectum following irradiation, both in air and hyperbaric oxygen, were studied in serial biopsies of rectal mucosa taken from patients who were being treated for advanced pelvic malignancies. The results indicated that during a course of irradiation the fibroblast cell count fell on a time-scale very closely associated with that seen in intestinal epithelial cells. Only some immediate recovery occurred in the fibroblast system, in contrast to the adjacent epithelial cell system where full recovery seemed to have taken place. The fibroblast system, moreover, showed a gradually diminishing trend during the first year, whilst the epithelial cell numbers appeared to have been maintained. The interpretation of these data are discussed. Evidence is provided that when patients breathe hyperbaric oxygen during irradiation more extensive depression of cell numbers occurred, but after recovery there was essentially no difference in the cell counts. (auth)

19929 RADIOSENSITIVITY IN ATAXIA-TELANGIECTASIA. Cunliffe, P. N. (Childrens' Hospital, Birmingham, Eng.); Mann, J. R.; Cameron, A. H.; Roberts, K. D.; Ward, H. W. C. Br. J. Radiol.; 48: No. 569, 374-376(May 1975).

Ataxia-telangiectasia is a syndrome of autosomal recessive inheritance. The basic karyotype is normal but there are characteristic chromosomal changes. These chromosomal changes are similar in many respects to those of irradiation damage in previously normal individuals. Immunological deficiency and an increased incidence of malignancy are also exhibited. A case history is recorded of a seven-year-old boy with ataxia-telangiectasia. Chest x-ray examination revealed a tumour in the right lung, and pneumonectomy was followed by radiotherapy. The child was abnormally radiosensitive; dysphagia and erythema developed after 2,000 rads of 230 kV x-rays (mid-plane dose of 200 rads per day, five days per week). The symptoms worsened and treatment was stopped at 3,000 rads. His condition deteriorated in spite of treatment with prednisolone, and he subsequently died. It is suggested that radiotherapy should be avoided whereever possible in patients with ataxia-telangiectasia. (UK)

19930 RADIATION PROTECTION. Introduction to Radiation Hygiene. Weber, J.; Rausmussen, C. E. Delft; Delftse Uitgeversmaatschappij (1974). 187p.

This book gives a systematic description on theoretical basis of the hazards inherent to all kinds of radiation (x and γ rays, radionuclides, and neutrons) both natural (cosmic rays) and man-made. This involves a survey of measuring methods, physiological effects, screening and other safety measures. Practical numerical data are profusely given, and at the end of most of the twelve chapters a number of questions are presented with their answers at the end of the book. The last chapter deals with legal matters: the directives given by international organizations and their embodiment in the Netherlands. (NL)

19931 REPORT OF THE TASK GROUP ON REFERENCE MAN. International Commission on Radiological Protection No. 23. Oxford; Pergamon Press (1975). 499p.

The report is presented in sections entitled: anatomical values for reference man (total body; integumentary system; skeleton, cartilage, nonskeletal dense connective tissue and teeth; hematopoietic system, lymphatic system, spleen and thymus; skeletal muscle system; cardiovascular system; digestive system; respiratory system; urogenital system; endocrine system; central nervous system; special sense organs; pregnancy); gross and elemental content of reference man; physiological data for reference man. (UK)

19932 DAMAGE TO TEETH RESULTING FROM RADIATION THERAPY FOR MALIGNANCIES IN THE HEAD AND NECK REGION. Koppang, H. S. (Univ., Oslo). Nor. Tannlaegeforen. Tid.; 85: No. 4, 159-164(Apr 1975). (In Norwegian).

19933 EFFECT OF ACUTE IRRADIATION ON THE EXOCRINE SECRETION OF THE PANCREAS IN THE PIG. Corring, T. (Centre National de Recherches Zootechniques (CNRZ), 78 - Jouy-en-Josas (France). Lab. de Physiologie de la Nutrition); Daburon, F.; Remy, J. (CEA, 78 - Jouy-en-Josas (France). Lab. Etable de Radiobiologie Appliquee). Strahlentherapie; 149: No. 4, 417-425(Apr 1975). (In French).

4 figs.; 2 tabs.; 16 refs.

Six fistulated pigs were used in this experiment to study the effect on the exocrine pancreatic secretion of a partial acute irradiation at 600 rd and 800 rd. Whatever the dose, the irradiation provoked an immediate and temporary decrease of the pancreatic secretion. The normal values were reached after the 8th day post-irradiation. Furthermore, a direct effect on the synthesis of amylase and lipase was shown. The synthesis of trypsin and chymotrypsin was scarcely modified by irradiation. (auth)

19934 RENAL STRESS DURING PERCUTANEOUS ABDOMINAL RADIOTHERAPY. Schmidt, N.; Tkocz, H. J.; Leetz, H. K.; Deveny, A. (Universitaet des Saarlandes, Homburg/Saar (F. R. Germany). Inst. fuer Biophysik). Strahlentherapie; 149: No. 4, 378-383 (Apr 1975). (In German).

4 figs.; 14 refs.

Percutaneous abdominal radiotherapy leads to an obligatory simultaneous stress of the kidneys. This partial stress of the kidneys can be reduced to a bearable minimum if the medicophysical irradiation planning methods, already developed nowadays, are used. The improved irradiation technique basing on these methods was examined, by administering abdominal irradiation, in a corresponding collection of patients. Clinical, laboratory-chemical, roetgenologic, and nucleomedical examinations were carried out in different intervals. The insignificant control results certified the kidney protecting method of our radiotherapy. (auth)

19935 GRAVES' OPHTHALMOPATHY FOLLOWING EXTERNAL NECK IRRADIATION: EVIDENCE FOR IMMUNOLOGIC PATHOGENESIS. Wenzel, K. W.; Schleusener, H.; Weise, W. (Freie Univ. Berlin (F. R. Germany). Nuklearmedizinische Abt.; Freie Univ. Berlin (F. R. Germany). Abt. fuer Innere Medizin mit Schwerpunkt Endokrinologie; Bundesgesundheitsamt, Berlin (F. R. Germany). Robert Koch-Institut). Dtsch. Med. Wochenschr.; 99: No. 41, 2036-2039(Oct 1974). (In German).

1 fig.; 30 refs.

The development of unilateral endocrine ophthalmopathy was observed in a 60-year-old woman ten years after thyroid-affecting radiotherapy for a breast cancer. New concepts of immunological causes of Graves' disease and Graves' ophthalmopathy and common lymphatic drainage pathways of the thyroid and orbits are discussed. It is postulated that the cause for cell mediated immunity of the orbital muscles is a change in their immunological behavior due to contact with thyroglobulin from the thyroid lymphatic drainage system. After disruption of immunological tolerance these immunologically altered tissues may become a site for the T-lymphocyte-mediated immunoreaction. (auth)

19936 NEW EXPERIENCES WITH RADIOTHERAPY OF PRIMARY CARCINOMA OF THE VAGINA AS WELL AS NOTES ON A REFINED TARGET VOLUME CONCEPT. Gauwerky, F.; Koester, R. (Allgemeines Krankenhaus St. Georg, Hamburg (F. R. Germany). Inst. fuer Strahlentherapie und Nuklearmedizin). Strahlentherapie; 149: No. 3, 227-240(Mar 1975). (In German).

8 figs.; 5 tabs.; 29 refs.

Based on an analysis of a small new series of carcinomas of the vagina, observed in St. Georges General Hospital, Hamburg, a five year cure rate of more than 59% as a result of radiotherapy alone in 27 cases has been stated. This improvement can be attributed to an individualized use of localized Curie therapy. The study gives a chance to discuss the target volume concept for combined radiotherapy of gynecological cancers. It is distinguished between target volumes of 1st, 2nd, and 3rd order. The difficulties arising when the different components of combined radiotherapy of gynecological tumors have to be summed up, cannot easily be overcome. (GE)

19937 XERORADIOGRAPHIC HNO-DIAGNOSTICS. Schertel, L. (Freie Univ. Berlin (F. R. Germany). Strahleninstitut und -klinik). Roentgenpraxis; 27: No. 11, 249-258(Nov 1974). (In German).

10 figs.; 14 refs.

After a short description of the method of xeroradiography and a survey of the possible uses, advantages, and disadvantages of xeroradiographic diagnostics, the resulting radiation exposure is treated in more detail. Although the radiation doses required are higher than those of film radiography by a factor of 10 to 20, xeroradiography can be used in the HNO region since the higher screen dose is achieved with a lower incident dose. Application of xeroradiography in tomography does, however, call for a particularly narrow indication. (GE)

19938 DEVELOPMENT AND COMPARISON OF COMPUTER METHODS FOR ORGAN MOTION CORRECTION IN SCINTIGRAPHY.

Schmidlin, P. (Deutsches Krebsforschungszentrum, Heidelberg). Phys. Med. Biol.; 20: No. 3, 465-476(May 1975).

The process of organ motion correction in scintigraphy is analysed in the frequency domain. The sequence of the x- and y-coordinates registered during scintigraphic recording was converted to a frequency spectrum by a discrete Fourier transformation. In the frequency domain, motion correction was performed by linear filtering. Every convolution filter in the time domain corresponded to a linear filter in the frequency domain, and the filter form in the frequency domain was a good measure of the quality of the correction. With the aid of frequency analysis simple convolution filters in the time domain were developed. The usual centre of gravity method is not a convolution filter and had an unfavourable frequency behaviour. By means of phantom measurements the following correction methods were tested: the usual (non-convolutional) centre of gravity method, the convolutional centre of gravity method, a weighted convolutional centre of gravity method and the Fourier filtering method. (auth)

19939 POSSIBLE USE OF ASTATINE IN NUCLEAR MEDICINE. Samson, G. (Univ. of Amsterdam). Nucl.-Med., Suppl.; No. 12, 506-508(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Astatine-211 might be used for thyroid therapy in humans. Prior to that application, the distribution of astatine in human beings must be studied; the most suitable isotope for this purpose is ^{210}At which emits relatively few alpha particles and nearly 100% x rays. The use of ^{211}At for specific immunosuppression in humans is not very attractive; the greatest part of the dissipated energy is released outside the target. Probably more promising is the application of ^{211}At attached to damaged erythrocytes for selective irradiation of the spleen. (auth)

19940 NEW POSSIBILITIES OF RADIONUCLIDE THERAPY OF EXTENSIVE TUMORS OF THE THORAX WALL, LUNGS, VULVA, BLADDER, RECTUM, AND OTHER LOCATIONS. Schumacher, W. (Rudolf-Virchow-Krankenhaus, Berlin). Nucl.-Med., Suppl.; No. 12, 608-616(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

A new technique in the placement of ^{198}Au seeds along a great circle or on the surface in a tumor leads to the possibility of causing the complete degeneration of even large cancers. In very extensive tumors the combination with teleirradiation (betatron or telegamma) has surprisingly effective curative results. Experience has shown that in a quick degeneration no unfavorable side effects such as abcesses or ulceration occur. A combination treatment with external megavolt therapy gave good results for the treatment of deep neoplasms. Since not all tumors can be extirpated, radiogold seed implantation can substitute for surgery and give comparable results. (tr-auth)

19941 CLINICAL AND THEORETICAL ASPECTS OF THE TREATMENT OF SURGICALLY UNRESECTABLE RETROPERITONEAL MALIGNANCY WITH COMBINED INTRA-ARTERIAL ACTINOMYCIN-D AND RADIOTHERAPY. Wiley, A. L.; Wirtanen, G. W.; Joo, P.; Ansfield, F. J.; Ramirez, G.; Davis, H. L.; Vermund, H. (Univ. of Wisconsin, Madison). Cancer; 1: No. 1, 107-122(Jul 1975).

A small pilot series (eight patients) of surgically unresectable retroperitoneal tumors treated with radiotherapy and a selective, prolonged, continuous intra-arterial infusion of actinomycin-D is discussed, in addition to the possible theoretical advantages for this therapy. For such tumors, there is a very low probability of obtaining local control with conventional radiotherapy alone. However, on the basis of recent knowledge from radiobiology and molecular biology, the technique is a rational attempt to improve the local control probability. Geographic miss with radiotherapy portals is another major cause for local failure with such tumors. We also emphasize the importance of detailed tumor localization procedures. The local responses, some of the local controls, the palliation achieved, and the lack of significant morbidity with this technique have been encouraging. We therefore consider it worthy of further clinical investigation. (auth)

19942 INTRAVAGINAL DOSE DISTRIBUTIONS FROM TELE-COBALT PENDULUM IRRADIATION OF THE UTERINE CERVIX CARCINOMA. Kniep, W. Hamburg; Univ. Hamburg (1971). 61p. (In German). INIS.

Thesis.

A comparison was made of the dose distributions measured in the mid-pelvic plane on plexiglass-water phantoms and on human patients to discuss the different factors influencing the dose distribution as a function of the method of irradiation applied (pendulum angle, distance between pendulum axes, field intensity). (GE)

19943 EXPERIMENTAL STUDIES TO THE DOSE DISTRIBUTION FROM PENDULUM IRRADIATION OF THE MIDDLE PART OF THE ESOPHAGUS WITH ELECTRONS AND X RAYS FROM A 42 MeV BETATRON. Bark, R. Heidelberg; Univ. Heidelberg (1973). 39p. (In German). INIS.

Thesis.

Experimental studies of the dose distributions in the area of the middle esophagus resulting from pendulum irradiation with electrons and X-rays are reported. In these studies the energy and the arrangement of the pendulum angle were to be varied so as to generate the maximum possible dose decrease from the focal area to the healthy tissue. The electron energies used were 30 and 42 MeV, the energies of ultrahard rays were 42 MV. All studies carried out with the different pendulum angles indicated that electron therapy is in no way capable of meeting the existing requirements in terms of low exposures of the lung, bone marrow, and skin. However, the use of ultrahard x rays offers much better dose distribution conditions. These can be achieved only by bisegmental pendulum irradiation under a bilateral angle of 70° (30° dorsal, 40° ventral). (GE)

19944 EXPERIENCES IN THE COMPUTER APPLICATION FOR ROUTINE IRRADIATION PLANNING IN MEGAVOLT THERAPY. Birk, R.; Reiser, B. Heidelberg; Univ. Heidelberg (1973). 81p. (In German). INIS.

Thesis.

Dose distributions of a total of 64 patients were calculated. The extent to which individual factors like varying thickness of the body or situation and size of the tumours affect the dose distribution was investigated. Better irradiation procedures and better qualities of radiation were sought and applied. The calculated dose distributions were typed out by computer and then demonstrated and discussed. It was found that in common indications the individual dose distributions do not differ remarkably when indications and irradiation procedures are the same for every patient, and that it is therefore unnecessary to compute the dose distribution of every individual patient. As some physicians are uncertain about the dose distributions after less common irradiation procedures, it is advisable in less common indications to compute the dose distributions individually with regard to the irradiation method as well as the quality of radiation. In some cases (e.g., kidney, para-aortal lymphatic node) better irradiation procedures or better qualities of radiation were found. (GE)

19945 EXPERIMENTAL INVESTIGATIONS INTO THE DOSE DISTRIBUTION FROM ELECTRON IRRADIATION OF THE LOWER JAW REGION WITH ONE FIELD OF INCIDENCE ONLY. Spitzer, G. Heidelberg; Univ. Heidelberg (1973). 25p. (In German). INIS.

Thesis.

The object of the work was to determine the dose distribution in the region of the mouth when irradiating with fast electrons using one field of incidence only. The field quantity of 6 × 8 cm with lateral as well as mental angle of incidence with electron energies of 5, 10, 15, 20, and 30 MeV were used. A 42-MeV Siemens betatron served as irradiation apparatus. The photometric determined dose distributions are graphically presented and discussed. A better dose distribution was found with the lateral angle of incidence. Electron energies of 10 and 15 MeV proved to be favorable. A good dose distribution could be obtained with an electron energy of 10 MeV in order to influence the course of sickness in the lower jaw. Electron energies of 15 MeV are particularly suitable for therapeutically dealing with the floor region of the mouth. (GE)

19946 IRRADIATION METHODS OF THE TREATMENT OF MALIGN PROCESSES OF THE SPINAL COLUMN WITH MAXIMUM INDULGENCE OF THE SPINAL MARROW. Fallahzadeh-Teherani, C. Homburg, Ger.; Univ. Saarlandes (1972). 24p. (In German). INIS.

Thesis.

A series of systematic measurements was employed to find an irradiation method for betatron electron radiotherapy of malignant spinal tumors with maximum protection of the spinal marrow. Pendulum irradiation with fast electrons seemed most appropriate, since the spinal canal can be protected by energy reduction. The angle of pendulum oscillation was adapted to the anatomic structure (Alderson phantom, plexiglass water phantom). The measurements showed that a satisfactory dose distribution is achieved at an axis depth of 8 cm with central location of the center of rotation and a pendulum angle of 81° (with bilateral irradiation with 42 MeV electrons from +30 to −30°). The dose distribution is somewhat better than with the conventional methods of teleradiotherapy by means of a cobalt pendulum. Vertebral

bodies and spinal processes do not receive less than 70% of the maximum dose while the spinal canal and the adjacent bones receive significantly lower doses. The measured dose distributions allow the conclusion that this method of irradiation may also be useful in the treatment of malignant tumors elsewhere in the body. Satisfactory protection of the spinal canal is achieved. (GE)

19947 NEW METHOD FOR ESTIMATING GAMMA-RAY EXPOSURE SUSTAINED IN RADIATION ACCIDENTS. Possibilities of Using Organic Substances as Monitor. Nakajima, T.; Watanabe, S. (Instituto de Energia Atomica, Sao Paulo (Brazil)). J. Nucl. Sci. Technol. (Tokyo); 11: No. 12, 575-582(Dec 1974).

A new method is proposed for estimating the amount of exposure to γ rays sustained by victims involved in a radiation accident. The concept is to use as measure of exposure the quantity of free radicals generated in organic materials by irradiation, and to determine this quantity through its relation to the electron spin resonance shown by substance containing such radicals. Applying this method, a minimum exposure of about 100 R could be estimated with measurements at room temperature. The monitor substances taken up for the present series of experiments included nails and hair taken from exposed persons, plastic button, polyethylene powder, lucite, paper, and wool. The experiments were aimed at determining the sensitivity, the fading with lapse of storage time after irradiation, and the effects of differences in conditions of storage such as temperature, illumination, and washing before measurement. The method thus developed should prove useful for estimating the extent of exposure, to serve in deciding the medical treatment to be applied. (auth)

19948 LATE RADIATION EFFECTS: STATUS AND NEEDS OF EPIDEMIOLOGIC RESEARCH. Miller, R. W. (National Cancer Inst., Bethesda, MD). Environ. Res.; 8: No. 2, 221-233 (Oct 1974).

Epidemiologic studies of late radiation effects in man are reviewed, based on exposure to the atomic bomb, radiotherapy, diagnostic radiations, and occupational or accidental exposures. Areas studied include: genetic effects, fertility, immunology, cancer, congenital malformations, growth and development, aging, cataracts, psychiatric effects, interactions with drugs or viruses, host susceptibility, and radiation factors. Cancer areas discussed include leukemia; thyroid, lung, breast, bone, and liver cancers; lymphoma; salivary gland tumors; brain tumors; nonleukemia cancers; intrauterine exposures; and preconception irradiation and childhood cancers. (Pollut. Abstr.)

19949 RESULTS OF HIGH DOSE RADIATION AND SURGERY IN THE TREATMENT OF ADVANCED CANCER OF THE HEAD AND NECK. Carifi, V. G. (Martland Hospital, Newark, NJ); Ohanion, M. L.; David, A. B.; Greenlaw, R.; Rush, B. F. Jr. Am. J. Surg.; 128: No. 4, 580-582(Oct 1974).

From 20th annual meeting of the Society of Head and Neck Surgeons; Honolulu, Hawaii (14 Apr 1974).

One hundred nineteen patients with stage III or IV cancer of the oral cavity or laryngopharynx were treated with combined radiation therapy and surgery at the University of Kentucky and the New Jersey Medical School since 1962. In the University of Kentucky series, the three year postoperative survival figures in patients with stage III or IV lesions were 43 percent for lesions of the laryngopharynx and 39 percent for lesions of the oral cavity. Of great interest are the survival figures for patients with stage IV lesions: 50 percent for those with lesions of the laryngopharynx and 11 percent for those with lesions of the oral cavity. Although the New Jersey Medical School series is still young, the results (by actuarial projection) approached those of the University of Kentucky series and will be interesting to follow. (auth)

19950 DOSES TO THE VERTEBRAL MARROW DURING COMMON X-RAY EXAMINATIONS IN CLINICAL SITUATIONS. Seidlitz, L.; Margulis, A. R. (Univ. of California, San Francisco). Invest. Radiol.; 9: No. 6, 419-424(1974).

From annual meeting of the Association of University Radiologists; Vancouver, British Columbia (May 1973).

Increasing concern about somatic effects of low doses of x radiation to blood-forming organs led to direct measurements of the exposure of 60 adult patients during actual clinical procedures in a university teaching hospital. The peak skin exposure ranged from 1.99 R for an intravenous pyelogram to 263 R for abdominal angiography. From these measurements, the vertebral marrow doses were calculated and the peak values were found to range from 0.11 to 54 rad. The integral dose to the entire vertebral marrow ranged from 90 to 5400 g-rad in abdominal angiography and from 760 to 2900 g-rad in cardiac cineangiography. The magnitude of these doses points to the need for a conservative approach to multiple-injection angiography in view of indications of somatic damage from irradiation. The exposure given in these examinations should be consciously minimized. (auth)

19951 RADIATION DOSIMETRY AND INTRAORAL RADIOGRAPHIC TECHNIQUES. I. X-Ray Beam Patterns Within the Head. Frey, N. W. (Univ. of California, Los Angeles); Wuehrmann, A. H. J. Oral Surg.; 38: No. 1, 151-160(Jul 1974).

The clinical objective of this study was to determine comparative dose distributions delivered to the patient's head by seven intraoral radiographic techniques. These techniques included three kilovoltages (50, 65, and 90 KVP), three source-to-skin distances (4.5, 8.5, and 16.5 inches), and two types of position-indicating devices (lead-lined cylinders and pointed plastic cones). In Part I of this study, sheets of unexposed radiographic film were placed between layers of a Rando phantom head for exposure by all techniques. A bitewing film was constantly in a clinically useful position. Study of exposed films indicated the size, shape, and orientation of each primary beam within the head. Shorter position-indicating devices produced wider primary beam outlines than long devices. Radiation absorption by metal foil backings in bitewing film packets and radiation scattering outside the primary beam were visualized. (auth)

19952 MEDICAL ASPECTS OF RADIOACTIVE SPRINGS. Morinaga, H. (Okayama Univ., Misasa, Tottori (Japan). Inst. for Thermal Spring Research). Onsen Kagaku; 25: No. 2, 45-54(Oct 1974). (In Japanese).

In Japan, medical, especially clinical, researches on radioactive springs were started by Prof. Y. Oshima and his colleagues in 1945, at Balneological Institute of Okayama University at Misasa Spa. He wrote "Balneotherapy of radioactive springs in Japan" in Modern Therapeutics (Nakayama-Shoten, 1959). The author mentioned about some medical aspects of radioactive springs thereafter. The headings were as follows: bird's-eye view of strong radioactive springs in Europe; "thermalstollenkur" at Badgastein-Böckstein in Austria; inhibition of activity of adrenalin by radioactive spring water; radon concentrations in the air of galleries of uranium-mine of Ningyō-Tōge, and in the air of Misasa Spa areas; radioactive spring researches in USSR; do bad effects occur from radioactive spring waters?; and difference between radioactive rain following the explosion of an atomic bomb and radioactive spring water. (auth)

19953 CLINICAL PICTURE, DIAGNOSIS, AND TREATMENT OF RETICULOSARCOMA OF THE UPPER JAW. Vorobiev, Yu. I. Stomatologiya (Moscow); 53: No. 1, 34-37(1974). (In Russian).

The work was based on the experience of diagnosis and treatment with the assessment of remote results in 15 patients (among them 14—male) with histologically confirmed diagnosis of reticulosarcoma of the upper jaw. Despite comparatively short anamnesis of the disease, the majority of the patients were admitted to the clinic with advanced stages of the disease. Signs pointing to an expansive character of growth of the neoplasm were found in some of the cases roentgenologically. Megavolt radiation therapy (applied individually) led to a 3-year recovery in 4 of 15 patients. Sum total dose should constitute not less than 5000 rad with the duration of the therapeutic course of 5 weeks. Taking into consideration a great tendency to metastasis to the regional lymph nodes (in 9 of 15 patients) the author considered it expedient to carry out the so called prophylactic irradiation of the zone of submaxillary and cervical lymph nodes at the site of affection. (auth)

19954 COMBINATION OF ^{32}P AND TESTOSTERONE IN THE TREATMENT OF PAIN DUE TO OSSEOUS METASTASIS OF PROSTATE NEOPLASMS. Garcia De La Pena, E.; Sanchez Martin, J. A.; Linazasoro, J. M.; Cifuentes Delatte, L. (Universidad Autonoma, Madrid). Rev. Clin. Esp.; 134: No. 6, 527-534(30 Sep 1974). (In Spanish).

Testosterone administration together with ^{32}P to 14 patients with prostatic cancer and bone metastasis and intense pain resistant to estrogen and narcotics, greatly improved pain and motility. This effect seems to be due to the increased uptake of the isotope by the bone potentiated by testosterone. The results obtained were: Excellent in 28.6%; good in 57.2%; middle in 7.1%; and poor in 7.1%, which correspond to the only patient with pure osteolytic lesions. (auth)

19955 COMPARATIVE STUDIES ON THE RADIATION DOSAGE IN VARIOUS PANORAMIC RADIOGRAPHIC PROCEDURES. Sonnabend, E. (Univ., Munich). Stsch. Zahnaerztl. Z.; 29: No. 9, 730-733(Sep 1974). (In German).

When comparing radiation dosages in the various techniques of panoramic radiography, it should be known prior to taking the x-rays that surface exposure with intraoral tubes is about 50 times higher than with tomography. As to the gonadal dosage, there are no significant differences in the various techniques of panoramic radiography. Gonadal dosage-even with lead aprons-is considerable smaller than in intraoral full-mouth radiography with 11 and more exposures. This is the particular advantage of all panoramic radiography. (auth)

19956 EXPERIENCES WITH THE TREATMENT OF BILATERAL RETINOBLASTOMA. Kloucek, F.; Kadlecova, V.; Divisova, G. Cesk. Oftalmol.; 30: 13-22(Jan 1974). (In Czech).

The authors report on the complex treatment of four children with bilateral retinoblastoma. The more inflicted eye was enucleated, the other treated conservatively by a combination of radiotherapy (telegammatherapy, Stallard's ^{60}Co discs), chemotherapy (intraocular, intramuscular and peroral administration), and photocoagulation. Three of the treated children can be considered as cured. Two of them have aphakia after operation of postradiational cataract and have an applicable visual acuity. The third patient has a low vision for postradiational keratopathy and cataract. The fourth patient is still in treatment but his visual prognosis in unfavourable. The advantages and disadvantages of the particular therapeutical means are discussed. Radiotherapy seems to be the most effective. The treatment of bilateral retinoblastoma should be concentrated in the care of specialized teams. (auth)

19957 EARLY AND LATE COMPLICATIONS AFTER TREATMENT OF EYE NEOPLASM BY MEANS OF RADIOACTIVE COBALT. Maciejewski, Z. Klin. Oczna; 44: 581-584(Jan 1974). (In Polish).

In the course of treatment of ocular neoplasm by means of radioactive cobalt applicators one can observe a number of complications, which are the effect of radient energy upon the tissues and reaction of the eye to the disintegration of the tumor. Erroneous interpretation of these symptoms is in many cases the cause of mistakes and of the premature decision as to the enucleation of irradiated eye bulb. In doubtful cases a second opinion is indicated; this should be done in the department in which radiation therapy was carried out. (auth)

19958 HEALTH EFFECTS OF LOW-DOSE RADIATION: PROBLEMS OF ASSESSMENT. Landau, E. (Bureau of Radiological Health, Rockville, MD). Int. J. Environ. Stud.; 6: No. 1, 51-57(Mar 1974).

No successful systematic representation of the risks associated with exposure to ionizing radiation at low doses currently exists. Health effects of low-dose radiation as environmental hazards cannot be derived from experimental work alone. The Oxford Survey of Childhood Cancers, the X-ray technologists study by Miller and Jablon, and the pilot study of South Africa Au-U white miners are discussed in the selection of control populations. These sample studies illustrate the difficulties of avoiding faulty selection of controls and faulty analysis. (Pollut. Abstr.)

19959 ROLE OF RADIATION THERAPY IN THE CONTROL OF COLORECTAL CANCER. Raventos, A. (Univ. of California, Davis). Am. J. Dig. Dis.; 19: No. 11, 1036-1039(Nov 1974).

The present place of radiation therapy in colorectal cancer is reviewed. There is some evidence that a combination of radiation therapy with surgical resection improves the results of resection. It appears reasonable to continue use of this combination, particularly for patient categories in which resection is most likely to fail locally only, but optimal dosage and timing remain to be elucidated. More studies of combination therapy, carefully chosen and designed, are needed. (auth)

19960 CHYLOUS ASCITES AFTER RADIATION THERAPY FOR OVARIAN CANCER. Murray, J. M.; Massey, F. M. (Wilford Hall USAF Medical Center, Lackland AFB, San Antonio). Obstet. Gynecol.; 44: No. 5, 749-751(Nov 1974).

The three patients presented here were found to have chylous ascites after whole abdomen irradiation for ovarian malignancy, and the possibility of irradiation as an etiologic factor was considered. The physiology of fat absorption is discussed and a rational treatment method presented. (auth)

19961 TREATMENT OF INTESTINAL INJURIES FOLLOWING IRRADIATION. Mortensen, E.; Nilsson, T.; Vesterhauge, S. (Copenhagen Municipal Hospital). Dis. Colon Rectum.; 17: No. 5, 638-643(1974).

The cases of 16 patients treated for intestinal radiation injuries are reviewed. The conclusion is that in patients who have received radiation treatment earlier, it is never possible to rule out intestinal radiation injuries as the reason for abdominal complaints. The pathologic picture and the symptoms seem to be independent of the latency period and age. The possibilities for treatment are discussed, and it is concluded that only patients with slight injuries in whose cases cancer has been ruled out can be treated conservatively. For all other patients resection and perhaps closure of a fistula if it is possible should be done. This, however, was possible only in 25 percent of our patients. In the rest of the patients operated on it was only possible to establish a colostomy. (auth)

Vertebrates

19962 (AED-CONF-73-697-000, pp 133-137) NEW FINDINGS ON BIOLOGICAL-CHEMICAL RADIATION PROTECTION AND THE THERAPY OF RADIATION DAMAGE. Brueckner, V. 1973. (In German).

From meeting of the Schutzkommission by the Bundesministerium des Innern; Goettingen, F.R. Germany (Jun 1973).

Available from ZAED.

In Schutzkommission by the Bundesministerium des Innern. Papers presented at the meeting of Goettingen. (Bundesministerium des Innern, Bonn (F.R. Germany). Abt. Reaktorsicherheit und Strahlenschutz).

The possibility of preventing or at least reducing internal bleeding and bacteraemia in the radiation syndrome by increased blood coagulability or strengthening of the vascular walls was investigated. To increase blood coagulability, mice were given i.p. injections of heparin for four days successively. The last injection was given 24 h before exposure of the whole body to x-rays of 700 R. The heparin-treated animals were more radiation-resistant, with a survival of 60% as compared to the 35% of the control animals. In a similar experiment with the coumarin derivative Marcumar the survival rate increased significantly from 46 to 62%. Strengthening of the vascular walls was attempted by oral administration of the flavonoide Venoruton for 21 days after irradiation. The survival rate of the animals treated by this method was 56% as compared to 31% of the control animals. It is particularly important to note that this treatment provides a real therapy of radiation damage since the medicament was not administered until after irradiation. (GE)

19963 (CONF-751001-1) INFLUENCE OF WR-2721 ON METASTATIC TUMOR SPREAD AFTER IRRADIATION. Ullrich, R. L.; Jernigan, M. C.; Yuhas, J. M. (Oak Ridge National Lab., Tenn. (USA)). 1975. 4p. Dep. NTIS $4.00.

The Line 1 alveolar cell carcinoma is a transplantable murine tumor which, unlike most others, kills the host by means of metastatic spread. Attempts to cure this tumor with localized radiation therapy often fail, in spite of local tumor control, because the metastases evade the treatment. These facts suggest that host-tumor interactions may play a particularly important role in determining the ultimate survival of the tumor bearing animal. In order to initially evaluate the possible importance of normal regional tissues in host-tumor interactions the influence of WR-2721, a radioprotective drug, was examined for local tumor control and subsequent survival of the tumor bearing animal after localized radiation. Results indicated that WR-2721 can decrease metastasis. (CH)

19964 (COO-3085-42) REGULATIONS OF ENZYMES IN ANIMALS: EFFECTS OF DEVELOPMENTAL PROCESSES, CANCER AND RADIATION. Progress Report IX: Period Covered, 1 May 1974–31 April 1975. Knox, W. E. (New England Deaconess Hospital, Boston, Mass. (USA). Cancer Research Inst.). 1975. Contract E(11-1)-3085. 15p. Dep. NTIS $4.00.

Investigations of the properties of variant forms of enzymes in rat tissues were continued. Two glutamyltransferases, one which remains associated with glutamine synthetase and the other which can be separated from it, were purified. A new assay method for glutaminase activity was established which facilitated further characterization of the 3 isozymes and their concentration in normal and neoplastic tissues. Studies of arginase led to the demonstration of the role that the new variant of arginase plays in proline synthesis in mammary gland. An inhibitor of asparagine synthetase, which is absent from fetal liver and tumors, was discovered in adult rat liver. Peptidyl proline hydroxylase (an essential enzyme in collagen synthesis) was identified as one of the most sensitive indicators of neoplastic growth. The spectrum of experimental, transplantable rat tumors was extended to a series of salivary gland tumors and a radiation-induced lymphoma. (auth)

19965 (COO-3085-43) REGULATIONS OF ENZYMES IN ANIMALS: EFFECTS OF DEVELOPMENTAL PROCESSES, CANCER, AND RADIATION. Comprehensive Three-Year Progress Report, 1 May 1972–30 April 1975. Knox, W. E. (New England Deaconess Hospital, Boston, Mass. (USA). Cancer Research Inst.). 1975. Contract E(11-1)-3085. 31p. Dep. NTIS $4.75.

Controls by genes and by adaptive phenomena of the patterns of enzymes in several rat tissues were extended by systematic investigations during development, in neoplasms, and after x-irradiation. Newly developed quantitative assays for tryptophan pyrrolase and phenylalanine hydroxylase were used to study the mechanism of degradation after induction of the former enzyme. Systematic investigation of the isoenzymic variants and of the quantitative pattern of enzymes in numerous rat tissues led to the discovery of new variants, the determination of the functional role of certain

enzymes in specific tissues, and the identification of enzymes whose amount provides sensitive indicators fo neoplastic growth in rat liver and spleen. X-irradiation of young postnatal rats interfered with the development of some hepatic enzymes. This effect was distinct from that of tumor-bearing, and from abnormal hormonal or nutritional conditions. (auth)

19966 (COO-3264-11) INBORN ANEMIAS IN MICE. Progress Report, 1 May 1974–30 Apr 1975. Russell, E. S.; Bernstein, S. E. (Jackson Lab., Bar Harbor, Maine (USA)). 15 May 1975. Contract E(11-1)-3264. 20p. Dep. NTIS $4.00.

Hereditary anemias of mice were investigated. Preliminary results are reported for four macrocytic anemias, four hemolytic anemias, nonhemolytic microcytic anemia, transitory siderocytic anemia, sex-linked iron-transport anemia, and the autoimmune hemolytic anemia of NZB. These anemias were studied through: characterization of peripheral blood values, determinations of radiosensitivity under a variety of conditions, measurements of iron metabolism and heme synthesis, histological and biochemical study of blood-forming tissue, functional tests of the stem cell component, examination of responses to erythroid stimuli, and transplantation of tissue between individuals of differently affected genotypes. Considerable effort was devoted to perfection of hematologic, cell culture, and transplant methods to make these techniques useful in dealing with special problems associated with abnormal function. (auth)

19967 (COO-3380-17) DOSE AND RECOVERY IN RAT SKIN TUMOR INDUCTION: DATA AND A METHOD OF ANALYSIS. Albert, R. E.; Burns, F. J. (New York Univ., N. Y. (USA). Inst. of Environmental Medicine). 1975. 14p. (CONF-750473-1). Dep. NTIS $4.00.

From meeting on influence of radiobiological factors in estimation of risks of cancer induction for purposes of radiological protection; Brighton, UK (2 Apr 1975).

Results are reported from a number of studies on the carcinogenic effects of various doses of electrons, 10 MeV protons, and 40 MeV alpha particles in rat skin following either single or fractionated exposures. The incidence of tumors was determined for periods up to 80 weeks and a mathematical model for tumor induction was developed. (CH)

19968 (COO-3380-22) TUMORIGENIC ACTION OF BETA, PROTON, ALPHA, AND ELECTRON RADIATION ON THE RAT SKIN. Progress Report, August 1, 1974–July 31, 1975. Albert, R. E.; Burns, F. J. (New York Univ., N. Y. (USA). Inst. of Environmental Medicine). 1975. Contract AT(11-1)-3380. 16p. Dep. NTIS $4.00.

The carcinogenic effects of ionizing radiation (alpha, beta, electron, and protons) on rat skin were studied in an attempt to learn more about radiation carcinogenesis, especially how various parameters of the irradiation, such as dose distribution within the tissue and dose rate, affect the yield of tumors. It was found that when the dose was localized to a small region of skin, the tumor yield was reduced and the magnitude of the reduction indicated that the region of reduced response might extend about 150 mu into the irradiated zone. The proliferative state of the hair follicles at the time of irradiation had relatively little effect on tumor induction although old animals were less susceptible than young or newborn animals. The penetration requirement of at least 0.3 mm for producing tumors suggests that the hair follicle germ cells could be the oncogenic targets. Comprehensive experiments to measure the rate of recovery for tumor induction in split-dose exposure protocols indicated a recovery halftime of about 4 hrs for electrons and significant recovery for protons, which was used in a model to predict how recovery should affect the tumor response at low dose rates. Combinations of ionizing radiation and ultraviolet light were applied to rat skin to determine whether they are additive for producing tumors. (auth)

19969 (SAN-899X3) OBSERVATIONS ON HEMOPOIETIC MARROW. Comprehensive Report, July 1972–June 1975. (Scripps Clinic and Research Foundation, La Jolla, Calif. (USA)). Jun 1975. Contract AT(04-3)-899. 18p. Dep. NTIS $4.00.

Progress is reported on studies on the relationship between the structure of hemopoietic tissues and hemopoiesis. Cytochemical and histochemical methods were used for the classification of acute leukemias according to cell type and identification of the site of involvement of spleen cells in Hodgkin's and non-Hodgkin's lymphoma. The structure and function of bone marrow adipose cells were characterized. Results are reported from studies on the growth of bone tissues in previously whole-body (500 to 850 rads) irradiated mice following the implantation of isologous bone marrow. (CH)

19970 (UR-3055-15) POSSIBLE RELATIONSHIPS BETWEEN THE EARLY INFLAMMATORY RESPONSE AND SUBSEQUENT FIBROSIS IN RAT SKIN AFTER IRRADIATION. Ullrich, R. L. (Rochester Univ., N. Y. (USA). School of Medicine and Dentistry). 1975. 143p. Dep. NTIS $10.25.

Thesis.

The possible mechanistic relationships between the early inflammatory response and subsequent fibrosis seen after radiation exposure was studied in rats were given single x ray doses of either 2000 or 5000 rads to standardized fields of the inner thigh. The results suggest that two mechanisms are responsible for the radiation-induced increase in extravasation rate and vascular injury seen early after irradiation. First, direct cytocidal damage of the endothelium; and second, chemically mediated, possibly complement dependent mechanisms. Indirect histological evidence suggests a correlation between the PMN infiltrate and the indirect vascular damage. In addition, one may conclude from these data that both direct and indirect damage to the vasculature play a role in influencing the subsequent late radiation-induced fibrosis; and a decrease in the indirect damage may allow the maintenance of a supportive vasculature at lower doses or allow the reestablishment of a vascular bed in the case of higher doses. (CH)

19971 CHANGES IN LACTATE DEHYDROGENASE AND ALKALINE PHOSPHATASE IN SERUM OF MICE AFTER X IRRADIATION. Takamori, Y. Annu. Rep. Radiat. Center Osaka Prefect.; 15: 96-99(1974).

Changes in the activities of LDH and alkaline phosphatase in the serum of mice were investigated in detail from the 2nd day to the 30th day after whole-body x irradiation of 400 R, a dose which produces 13%, 30-day-mortality. Serum LDH levels were significantly decreased during the first 6 days after irradiation, but subsequently returned to a normal range by the 14th day. Serum alkaline phosphatase levels were decreased to a minimum on the 12th day and they returned gradually to a level slightly below control level by the 22nd day. The serum LDH and alkaline phosphatase levels seem to be good indicators of radiation injury in mice during 2 to 3 weeks after irradiation even if they were exposed to a sublethal dose. (auth)

19972 PHYSIOLOGICAL AND PHARMACOLOGICAL PROPERTIES OF PURKINJE CELLS IN RAT CEREBELLUM DEGRANULATED BY POSTNATAL X IRRADIATION. Woodward, D. J.; Hoffer, B. J.; Altman, J. (Univ. of Rochester, NY). J. Neurobiol.; 5: No. 4, 283-304(1974).

Elimination of most granule, basket, and stellate interneurons in the rat cerebellum was achieved by repeated doses of low level x irradiation applied during the first two weeks of postnatal life. Purkinje neurons in these rats, studied when adults, exhibited sustained spiking activity in Halothane anesthetized preparations. Mean firing rates were 35–40/sec, no different from normal. Spontaneous bursts presumed to be generated by climbing fiber synaptic activity differed from normal by often consisting of full sized spikes rather than characteristic inactivation responses. Intracellularly observed correlates of bursts consisted of epsp's of several discretely different amplitudes appearing independently in time. Stimulation of white matter revealed evidence for (a) graded synaptic excitation of Purkinje cells indicating more than one converging excitatory synapse, and (b) inhibitory actions on Purkinje cells either through a few remaining inhibitory interneurons or through Purkinje cell recurrent collaterals. Iontophoretic drug application studies showed normal chemosensitivity of the Purkinje cell membrane, i.e., excitation by glutamate and inhibition by gamma-amino butyric acid, serotonin, norepinephrine, and 3'5' cyclic AMP. These studies indicate considerable autonomy of Purkinje cell ontogenesis in the absence of normal interneuronal input. A unique synaptic relation only rarely found in normal cerebellum is the innervation of single Purkinje cells by more than one climbing fiber. (auth)

19973 DIFFERENTIATION OF HAEMOPOIETIC TISSUES FROM EMBRYOS AND ADULTS INJECTED INTO IRRADIATED CHICKENS. Samarut, J.; Nigon, V. (Lyon Univ., Villeurbanne, France). J. Embryol. Exp. Morphol.; 33: No. 2, 259-278(Apr 1975).

Three week old Leghorn chickens received doses of x rays of 760 R one day and 990 R a day later. They were then injected with hemopoietic tissues from adult or 11 day old embryos. Development of stem cells gave rise to well defined erythrocytic colonies on the surface of the tibial marrow. Erythropoietic production appeared to be similar from adult marrow and embryonic blood stem cells; production from injected vitelline stem cells seemed to be between 3 and 4 times higher than that of adult marrow stem cells. (UK)

19974 EFFECT OF IONIZING RADIATION IN COMBINATION WITH MICROWAVES ON PERMEABILITY OF BLOOD CELL MEMBRANES. Faitel'berg-Blank, V. R.; Orlova, A. V. Fiziol. Zh., Akad. Nauk Ukr. RSR; 21: No. 3, 410-412(1975). (In Russian)

The effect of x radiation in combination with electromagnetic fields of superhigh frequency was studied in 170 rats. It was established that irradiation at a dose of 300 R significantly changed the permeability of blood cell membranes. The electromagnetic field had a reverse effect to that of x radiation, promoting the normalization of the permeation processes of the natural barriers of the organism. (tr-auth)

19975 BIORHYTHMS. II. Disturbance of Circadian Rhythms of the Concentration of Paramagnetic Centres in the Organs of Mice Exposed to Ionizing Radiations. Kovalenko, O. A.; Ivannikova, A. G.; Chibrikin, V. M.; Piryuzan, L. A. (Inst. Khimicheskoj Fiziki, Moscow). Biophysics.; 19: No. 4, 718-722(Jun 1975).

The authors have studied the effect of x radiation on the circadian rhythms of the concentration of paramagnetic centres in the organs of mice. It was shown that in animals surviving 30 days after irradiation with a dose of 450 R, the character of the fluctuations in concentration of the paramagnetic centres in the liver and spleen differed from normal. (auth)

19976 RADIATION RESPONSE OF C3H FIBROSARCOMA ENHANCED IN MICE STIMULATED BY CORYNEBACTERIUM PARVUM. Suit, H. D.; Sedlacek, R.; Wagner, M.; Orsi, L. (Massachusetts General Hospital, Boston). Nature (London).; 255: No. 5508, 493-494(5 Jun 1975).

It is stated that treatment of laboratory mice with Corynebacterium parvum can increase the host reaction against tumors, and that in some mouse tumor systems chemotherapy is more effective when hosts are stimulated with C. parvum. The authors have now found that administration of C. parvum before local irradiation of fibrosarcoma isotransplants increases the frequency of cure, and strikingly so after low radiation doses. Some studies are reported using ^{137}Cs radiation as a single dose at 950 R/min. (UK)

19977 SELECTIVE BLOCKING OF THE NODAL SODIUM CHANNELS BY ULTRAVIOLET RADIATION. P.1. Phenomenology of the Radiation Effect. Fox, J. M. (Universitaet des Saarlandes, Homburg/Saar (F. R. Germany). Inst. fuer Physiologie 1). Pfluegers Arch.; 351: No. 4, 287-301(1974).

6 figs.; 3 tabs.; 30 refs.

The effect of ultraviolet radiation on the excitable membrane of the node of Ranvier was studied. Ultraviolet radiation blocks the sodium channel and shifts the steady state inactivation curve along the voltage axis in the negative direction. No other electrical properties of the nodal membrane such as resting potential, leak conductance, and potassium currents are substantially modified and the sodium channel is blocked as a whole, since after irradiation the not-blocked channels function normally (regarding the ionic selectivity and the activation mechanism). Tetrodotoxin does not interfere with the effect of ultraviolet radiation and the photoreaction does not depend on temperature. The action spectrum for blocking of the sodium system has a marked peak in the region of 280 nm wavelength. The potassium system shows no significant peak of uv-sensitivity. Its sensitivity at 280 nm is about a tenth in comparison to the uv-sensitivity of the sodium channels. (auth)

19978 INFLUENCE OF X IRRADIATION ON THE DIFFERENT STAGES OF THE CELL CYCLE IN REGENERATING RAT LIVER. Barbason, H. (Liege Univ. (Belgium). Lab. d'Anatomie Pathologique). Virchows Arch. Abt. B.; 16: No. 4, 363-369(1974).

2 figs.; 1 tab.; 16 refs.

Five groups of rats are partially hepatectomized in the afternoon. The first is the non-irradiated control and the others are irradiated (450 R) at different postoperative delays of 1 h (hepatocytes in G_2), 12 h (middle of G_1), 20 h (end of G_1-beginning of S), and 28 h (S phase). When the irradiation is performed in G_2 or in G_1, the same inhibition of mitotic waves, micronuclei, and anatelophasic bridges index is observed. However, the mitotic delay induced by the irradiation in G_2 is completely reduced when the rats are irradiated after the middle of G_1. When the irradiation is performed in the S phase, the first mitotic wave is almost completely inhibited. On the contrary, the second mitotic wave is the same as in the other irradiated groups and the micronuclei and the bridges appear at its level. The results are discussed in the light of a possible relationship between the radiosensitivity and the different phases of the cell cycle. (auth)

19979 LOCAL KIDNEY IRRADIATION BY MEANS OF INTRA-ARTERIAL IMPLANTATION OF RADIOGOLD SEEDS. Animal Experimental Studies. Klein, U.; Bunde, E.; Chaussy, C.; Eisenberger, F.; Buendel, B.; Hammer, C.; Lissner, J.; Loehrs, U.; Pfeifer, H. G. (Univ., Munich). Nucl.-Med., Suppl.; No. 12, 632-634(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Studies in dogs on the intraarterial implantation of ^{198}Au seeds were made in order to standardize the method for the introduction of the seeds under radiation protection conditions, to follow the intraarterial distribution of the seeds in the kidneys, to observe the physiological behavior of the kidneys after introduction of the particles, and to estimate the radiation doses to the kidney region treated. Each of these aspects is discussed and the results obtained are reported. (JSR)

19980 MALE-SPECIFIC ANTIGENS. Evidence for Allelic Differences in Reciprocal Hybrid Mice. Uphoff, D. E. (National Institute of Health, Bethesda, MD). Transplantation; 20: No. 1, 78-81(Jul 1975).

Reciprocal hybrid females recognized an allelic difference between H-Y antigens of the strains NBL and C3Hf. Maternal influences on the expression of H-Y antigens and on the ability to recognize and respond to these antigens may be factors critical for demonstrating allelism. The diversity of available data suggests a complex allelic series. However, more complete data on other reciprocal hybrids will be required for a complete evaluation of both X and Y chromosome effects. (auth)

19981 INHIBITION OF TUMOR GROWTH IN SYNGENEIC CHIMERIC MICE MEDIATED BY A DEPLETION OF SUPPRESSOR T CELLS. Rotter, V.; Trainin, N. (Weizmann Inst. of Science, Rehovot, Israel). Transplantation; 20: No. 1, 68-74 (Jul 1975).

Syngeneic chimeric (lethally irradiated and reconstituted with syngeneic bone marrow cells) mice manifested an increased resistance to the development of Lewis lung carcinoma. In addition, these mice had a higher response to polyvinylpyrrolidone and a reduced reactivity to T mitogens. The present findings suggest that syngeneic chimeric mice lack suppressor T cells shown to regulate the development of Lewis lung tumor and the response to polyvinylpyrrolidone. Other components of the T cell population, such as helper cells responding to sheep red blood cells or cells involved in allograft rejection, assayed in these syngeneic chimeras were found unaffected. The fact that chimeric mice are deficient in a certain suppressor T cell population whereas other T activities are normal suggests the existence of different cell lines within the T cell population. (auth)

19982 INVESTIGATIONS ON THE METABOLISM OF NICOTINAMIDE-ADENINE-DINUCLEOTIDE AFTER WHOLE-BODY IRRADIATION OF WHITE MICE. Ell, N. Freiburg, i. B.; Univ. Freiburg i. B. (1973). 55p. (In German). INIS.

Thesis.

The NAD content of the spleen of albino mice was measured after whole-body irradiation. A decrease was found after 810 R at the 2nd and 6th day post-irradiation and after 510 R at the 6th day. Further, the activity of the NMN pyrophosphorylase in spleen and liver was determined following whole-body irradiation with 510 and 810 R. Besides fluctuations in activity during the first day, an increase of activity by 25% was found only in spleen at the 4th day after 810 R. In addition, the DNA content and the activity of the NAD pyrophosphorylase was determined in the nuclear fraction of spleen and liver after 810 R. The DNA content of the spleen showed a significant decrease while in the liver there was only a slight change. The enzymatic activity in the liver was always found to be in the range of the control value or increase. In the spleen, however, it was decreased and at the 4th or 6th day post-irradiation it could not be detected. The determination of the incorporation of radioactivity into the pyridine nucleotides after intraperitoneal injection of 10 μCi of ^{14}C-nicotinamide in the liver indicated a slightly increased NAD synthesis at the 6th day post-irradiation and a constant radioactivity in the NMN fraction as well as an increased incorporation of activity into the NSAD fraction at the 4th day after irradiation with 810 R. In the spleen, an increase of total activity, a decrease of NAD and NMN, and an increased incorporation into the NSAD fraction was found. Furthermore, following an irradiation with 810 R, the protein content in liver and spleen was measured as well as the spleen weight. Changes of NMN pyrophosphorylase activity and NAD content were found within the daily rhythm. The cause of the decreased NAD content in spleen and liver after irradiation is discussed. (GE)

19983 ANALYSIS OF THE KINETICS OF THE IMMUNE RESPONSE BY MEANS OF IONIZING RADIATION. Kalinkovitch, A. G.; Maximova, G. F.; Babichev, V. A.; Uteshev, B. S. (Second Moscow Medical Pirogov Inst.). Folia Biol. (Prague); 21: No. 3, 160-164(1975).

The inhibitory kinetics of the primary immune response was studied by means of lethal irradiation. CBA mice were immunized with sheep red blood cells and 48, 72, and 96 hours later, they were irradiated with 750 R. Afterwards, the number of direct plaque-forming cells was determined in their spleens during 58 to 66 hours at 4-hour intervals. After irradiation at 48 and

72 hours of the immune response, a plateau of different duration was obtained: 48 hours in the former and 24 hours in the latter case. In both cases, reduction in the PFC number began at about 96 hours of the response. The PFC reduction curves in these two series of experiments and those obtained 96 hours after irradiation and in control, non-irradiated mice were parallel. The mean half-time of the PFC number reduction as determined by these curves was 6 hours. The time of functioning of PFC in the spleen is discussed with respect to recruitment of proliferating precursors. (auth)

19984 EFFECT OF CONTINUOUS IRRADIATION UPON BONE MARROW HAEMOPOIETIC STEM CELLS IN MICE. Kalina, I.; Praslicka, M.; Marko, L.; Krasnovska, V. (Safarik Univ., Kosice, Czech.). Folia Biol. (Prague); 21: No. 3, 165-170(1975).

The effect upon the stem cells in mouse bone marrow of continuous irradiation at different daily exposure rates ranging from 1R to 1,000R was investigated by means of the exogenous spleen colony assay. At exposure rates between 1 and 50R/day, a stabilized state in the CFU value becomes established, its level decreasing with the increase in the daily exposure. Exposure rates between 80 and 1,000R/day lead to an initially steep, but later on flatter, decrease in CFU number until death of the animals. Mass deaths occur in mice when the CFU number falls below 5%. The results further delimit the range of exposure doses for which a dependence was found of the CFU number upon the total exposure dose of continuous radiation. (auth)

19985 EARLY CHANGES IN THE NUMBER OF HAEMOPOIETIC STEM CELLS IN IRRADIATED YOUNG RATS. Vacek, A.; Rakova, A.; Druzhinin, J. P. (Inst. of Biophysics, Brno). Folia Biol. (Prague); 21: No. 3, 199-202(1975).

The frequency of exogenous hemopoietic spleen colonies in whole-body irradiated rats, aged 4 to 5 weeks, was found to be linearly dependent upon the dose of inoculated bone marrow or spleen nucleated cells. The recovery rate of the number of hemopoietic stem cells in rats exposed to 300 R assessed on day 12 postirradiation was found to be faster in bone marrow than in spleen. (auth)

19986 METRONIDAZOLE (FLAGYL): IRON CATALYZED REACTION WITH SULPHYDRYL GROUPS AND TUMOR RADIOSENSITIZATION. Willson, R. L.; Searle, A. J. F. (Brunel Univ., Uxbridge, Eng.). Nature (London).; 255: No. 5508, 498-500(5 Jun 1975).

It is stated that the possibility of using hypoxic cell radiosensitising drugs as adjuncts in the radiotherapy of some forms of cancer is receiving renewed attention, and in particular administration of metronidazole to tumor bearing mice before exposure to x rays, has been found to reduce the radiation dose required to control the tumors by a significant amount. Preliminary clinical trials are in progress. This drug was originally chosen for study because of its nitro-group, which suggested it is a strong radical oxidant, and its favorable pharmacological and toxicological properties. Measurements of anoxic solutions did not show any appreciable reaction between this substance and the sulphydryl groups of cysteamine or dithiothreitol. Recent pharmacological studies with rat intestinal contents prompted the authors to reexamine the reaction of metronidazole with sulphydryl compounds and to investigate the possibility of catalysis by ferrous ions. Experiments are reported that show that the compound reacts with an iron-cysteine complex over time scales of the order of a second; a drug-iron-cysteine complex is formed which is subsequently reduced over a period of minutes. Reaction mechanisms are suggested. The effects did not occur with normally oxygenated tissue. Whatever the fate of the radicals involved it is clear that the reactions of metronidazole with cysteine and probably other sulphydryl compounds in the presence of ferrous ions are sufficiently fast to warrant consideration in the interpretation of the drug's mechanism of radiosensitizing and chemotherapeutic action. (UK)

19987 BIORHYTHMS. II. Disturbance of Circadian Rhythms of the Concentration of Paramagnetic Centres in the Organs of Mice Exposed to Ionizing Radiations. Kovalenko, O. A.; Ivannikova, A. G.; Chibrikin, V. M.; Piryuzan, L. A. (Inst. of Chemical Physics, Moscow). Biofizika; 19: No. 4, 702-706(1974).

The authors have studied the effect of x radiation on the circadian rhythms of the concentration of paramagnetic centres of the organs of mice. It is shown that in animals surviving 30 days after irradiation with a dose of 450R, the character of the fluctuations in concentration of the paramagnetic centres in the liver and spleen differs from normal. (auth)

19988 EFFECT OF HETEROLOGOUS TRANSPLANTATION OF H 4-II-E RAT HEPATOMA CELLS INTO THE CHEEK POUCH OF IRRADIATED HAMSTER. Muragishi, H. (Nagoya Univ. (Japan). Faculty of Medicine); Corpening, B.; Bottomley, R. H. Nagoya J. Med. Sci.; 37: No. 1-2, 1-22(Aug 1974).

A series of transplant-explant experiments using the H 4-II-E rat hepatoma cell line and golden hamsters have been carried out. The original tissue culture cells, which had a modal chromosome number of 51, implanted into the cheek pouches of irradiated hamster (400 rads) produced tumors which were typical hepatomas histologically. Cells from these tumors were placed back into tissue culture and were transferred twice more into the cheek pouches of irradiated animals and tissue culture. These were termed the first, second, and third selection, respectively. At each stage of selection, chromosome counts, karyotypes, and histological and biological characteristics of the cells were determined. The explant from the first selection tumors and that from the second selection tumors were found to have 53 and 54 chromosome modes, respectively. Two explants derived from separate animals in the third stage of selection each showed different modes of chromosome number (53 and 54). The explants with a modal chromosome number of 54 had a more homogeneous karyotype than those with 53 chromosomes, and the former appeared to be less malignant than the latter, as judged by transplantability, growth rate of the cells in the hydrocortisone treated hamster and the isologous host and histological appearance of the tumors. A possible relationship between cytogenetic variations and biological variations in the cells is discussed. (auth)

19989 PHYSIOLOGICAL AND PHARMACOLOGICAL PROPERTIES OF PURKINJE CELLS IN RAT CEREBELLUM DEGRANULATED BY POSTNATAL X IRRADIATION. Woodward, D. J.; Hoffer, B. J.; Altman, J. (Univ. of Rochester, NY). Neurobiology; 5: No. 4, 283-304(1974).

Elimination of most granule, basket, and stellate interneurons in the rat cerebellum was achieved by repeated doses of low level x irradiation applied during the first two weeks of postnatal life. Purkinje neurons in these rats, studied when adults, exhibited sustained spiking activity in Halothane anesthetized preparations. Mean firing rates were 35 to 40/sec, no different from normal. Spontaneous bursts presumed to be generated by climbing fiber synaptic activity differed from normal by often consisting of full sized spikes rather than characteristic inactivation responses. Intracellularly observed correlates of bursts consisted of epsp's of several discretely different amplitudes appearing independently in time. Stimulation of white matter revealed evidence for, (a) graded synaptic excitation of Purkinje cells indicating more than one converging excitatory synapse, and (b) inhibitory actions on Purkinje cells either through a few remaining inhibitory interneurons or through Purkinje cell recurrent collaterals. Iontophoretic drug application studies showed normal chemosensitivity of the Purkinje cell membrane, i.e., excitation by glutamate and inhibition by gamma-amino butyric acid, serotonin, norepinephrine, and 3'5' cyclic AMP. These studies indicate considerable autonomy of Purkinje cell ontogenesis in the absence of normal interneuronal input. A unique synaptic relation only rarely found in normal cerebellum is the innervation of single Purkinje cells by more than one climbing fiber. (auth)

19990 COMPARISON OF TASTE AVERSIONS INDUCED BY RADIATION AND LITHIUM CHLORIDE IN CS-US AND US-CS PARADIGMS. Barker, L. M.; Smith, J. C. (Florida State Univ., Tallahassee). J. Comp. Physiol. Psychol.; 87: No. 4, 644-654 (Oct 1974).

Conditioned taste aversions induced by ionizing radiation and LiCl were compared in both forward (CS-US, conditioned stimulus-unconditioned stimulus) and backward (US-CS) conditioning paradigms. Taste aversions were produced when a saccharin CS preceded or followed a 100-R radiation US by as much as 6 hr., but a 2 percent of body weight, .15 M LiCl US was effective only in CS-US pairings. It was argued that the ineffectiveness of a LiCl stimulus in US-CS pairings was not attributable to differences in the strength of the respective LiCl and radiation doses in that these doses yielded comparable aversions in forward pairings. These results were related to inadequacies of a sickness model of taste aversion conditioning. (auth)

19991 CONDITIONED TASTE AVERSIONS AND SPECIFIC NEED STATES IN THE RAT. Weisinger, R. S.; Parker, L. F.; Skorupski, J. D. (Univ. of Washington, Seattle). J. Comp. Physiol. Psychol.; 87: No. 4, 655-660(Oct 1964).

Rats were allowed to consume either sucrose or saline prior to being made ill by injection of either insulin or formalin, or by exposure to x rays. A 2-bottle preference test between sucrose and saline revealed that formalin was an effective agent in conditioning aversions to sucrose but not to saline. Similarly, injections of insulin were found to be effective in producing conditioned aversions to saline but not to sucrose. X irradiation produced strong aversions to either solution. The results are discussed with regard to the specific need states that insulin and formalin produce. (auth)

Invertebrates

19992 (UR-3055-14) CHARACTERIZATION OF AN ORGAN-SPECIFIC DIFFERENTIATOR SUBSTANCE. Steele, V. E. (Rochester Univ., N. Y. (USA). Dept. of Radiation Biology and Biophysics). 1975. 150p. Dep. NTIS $10.50.

Thesis.

Cell regeneration in planaria (Dugesia etrusca) was studied. An attempt was made to characterize a diffusible brain inhibitory substance, to elucidate its role in the maintenance of anterior-posterior polarity during head or tail regeneration, and to utilize its action in measuring the differentiative integrity of the stem cells following x-irradiation. (CH)

19993 DIFFERENCES BETWEEN DROSOPHILA MELANOGASTER AND ITS SIBLING SPECIES D. SIMULANS TO RADIORESISTANCE USING ISOFEMALE STRAINS FROM NATURAL POPULATIONS. Parsons, P. A. (La Trobe Univ., Bundoora, Australia). Int. J. Radiat. Biol.; 27: No. 3, 297-300(Mar 1975).

An investigation was carried out into the effects of high doses of ^{60}Co γ-irradiation (110 or 120 krads, dose rate about 470 krads per hour) on the two species Drosophila (melanogaster and simulans) for development and survival of adult flies. The results were recorded for the number of flies dead at 2 days after exposure. The responses of the isofemale strains of D. simulans varied, indicating that wild populations of D.simulans, like D.melanogaster, are polymorphic for genes determining radioresistance and radiosensitivity. All six strains of D.melanogaster tested were highly radioresistant in comparison with D.simulans. These results are compared to those obtained by exposing these species to other environmental stresses. (UK)

19994 ON THE EFFECTS OF IONIZING RADIATION EMITTED FROM ^{60}Co UPON THE DEVELOPMENT OF ASCARIS EGGS, 3. Kumagai, Y.; Kumagai, R.; Mori, N. (Nihon Univ., Tokyo. School of Medicine). Nihon Univ. J. Med.; 16: No. 3, 229-240(Sep 1974).

Eggs of ascaris worm (Ascaris suis) were irradiated with ^{60}Co-γ-rays in vitro and incubated to explore the effect of irradiation on the cleavage and development of the egg. Under the conditions of irradiation used in the present work, the results obtained may be summarized as follows: The larger the total irradiation dose is, the longer the latent period before the start of cleavage is and the more pronounced the delay in the process of cleavage. When the total irradiation dose is kept constant, the larger the dose rate is, the more remarkable the biological effects mentioned above are. (auth)

Radionuclide Effects (Internal Source)

Man

Refer also to abstracts 19709–19711, 19725, 19758, 19918, 19920, and 19930.

19995 (KFK-EXT-23/75-1) RESULTS OF MONITORING FOR INTERNAL TRITIUM CONTAMINATION AT THE KARLSRUHE NUCLEAR RESEARCH CENTER IN 1974. Schieferdecker, H.; Koenig, L. A.; Ritz, H. (Kernforschungszentrum Karlsruhe (F. R. Germany)). Jun 1975. 10p. (In German). Dep. NTIS (US Sales Only) $4.00.

During 1974 a total of 477 persons were monitored for tritium incorporation. This category of workers consisted of staff employed permanently at the Nuclear Research Center as well as of temporarily engaged persons during repair and maintenance work. The radiation exposure for the staff workers resulted mostly in doses between 50 and 200 mrem/a, whereas the temporarily engaged workers received a radiation burden of 1780 mrem per 50 persons during a working period of 96 months. (auth)

19996 CONTAINMENT OF UNSEALED SOURCES OF RADIONUCLIDES IN HOSPITALS. Moore, R. D. (Trent Regional Health Authority, Sheffield, Eng.). Br. J. Radiol.; 48: No. 569, 410(May 1975).

It is suggested that the standards recommended for equipping hospital radioisotope laboratories (Code of Practice for Protection of Persons against Ionizing Radiations arising from Medical and Dental Use, 1972, Her Majesty's Stationery Office, London) could result in unnecessary expenditure. In practice, radiological protection measures normally require more modest and less costly measures, unless exceptionally hazardous procedures are involved. Most radionuclide handling in hospitals is of such a nature that the likelihood of the occurrence of airborne activity is almost negligible except under accident conditions. Remedial measures following infrequent minor accidents such as spills could, in general, easily be taken without the necessity for an efficient fume cupboard, while still avoiding significant hazard to operators. If the procedures were part of a process leading to the production of radiopharmaceuticals, then the pharmaceutical requirements would be more exacting than those of radiological protection from airborne contamination, where the products are intended for intravenous injection. (UK)

19997 DOSIMETRY ^{129}Cs AND ^{131}Cs FOR HUMAN INTERNAL ORGANS. Chandra, R. (New York Univ., NY). Phys. Med. Biol.; 20: No. 3, 483-488(May 1975).

Cesium-131 and cesium-129 are useful for diagnostic purposes in nuclear medicine. An assessment was made of the contributions to an organ's radiation dose from self radiation due to the radionuclide distribution in the organ itself, and from the radiation dose to the same organ as a result of the radionuclide distribution in other organs. A five-compartment mammalian system was used as the model of human cesium metabolism. Some estimate was made of the magnitude of the range in radiation dose resulting from variations in such factors as body weight, age, sex, or state of health. The calculations showed that, in accordance with the much shorter physical half-life compared with human biological half-life of these cesium isotopes, the whole-body radiation doses did not differ markedly in the two patients studied. However the differing values of the long-term biological retention in the two patients resulted in widely different values of radiation doses to the compartment including the organs liver, kidneys, and spleen. (UK)

19998 QUANTITATIVE SEQUENTIAL IMAGING OF RADIONUCLIDE DISTRIBUTION USING THE WHOLE-BODY SCANNER AND THE GAMMA CAMERA: ABSOLUTE ACCURACY AND ASPECTS OF THREE-DIMENSIONAL RECONSTRUCTION. Budinger, T. F.; Gullberg, G. T.; Nohr, M. L.; McRae, J.; Anger, H. O. (Univ. of California, Berkeley). Nucl.-Med., Suppl.; No. 12, 2-15 (1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Progress is reported in quantitating the distribution of isotope within organs on sequential images of the whole body using the whole-body scanner, and on techniques of reconstructing the three-dimensional distribution from multiple gamma-camera views using a variety of different algorithms. (auth)

19999 MANAGEMENT OF THYROTOXICOSIS. Greig, W. R. (Royal Infirmary, Glasgow). Nucl.-Med., Suppl.; No. 12, 617-618 (1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The indications for the treatment of hyperthyroidism with drug therapy, thyroidectomy, or ^{131}I therapy are discussed. The results and complications are considered for each method of treatment. (CH)

20000 THERAPY OF HYPERTHYROIDISM WITH ^{131}I: RESULTS IN 1700 PATIENTS. Glanzmann, C.; Kaestner, F.; Magdeburg, W.; Horst, W. (Kantonsspital, Zurich). Nucl.-Med., Suppl.; No. 12, 619-621(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The risks of ^{131}I therapy of hyperthyroidism were calculated on the basis of thyroid weight and morphology, assimilation, and effective intrathyroidal half-life. (JSR)

20001 DELAYED REACTIVATION OF THE THYROID TISSUE AFTER ^{131}I TREATMENT OF AUTONOMOUS ADENOMAS. Kinser, J.; Roesler, H. (Inselspitals, Bern). Nucl.-Med., Suppl.; No. 12, 622-625(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

After ^{131}I therapy and after surgical enucleation of an autonomous adenoma of the thyroid there may be a period in which the response of the thyroid is limited and the iodine uptake values are in the hypothyroid range, although scintigraphically the toxic adenoma may remain decompensated, be compensated or scarred, or, in the case of post-operative patients, the thyroid appears morphologically normal and the patients are clinically euthyroid. This reaction is defined as a delayed reactivation of the thyroid tissue. After ^{131}I treatment it is seen 3 months after therapy but typically at 6 to 12 months after therapy the uptake values have returned to normal. After surgery this reaction is seen when the patient is examined within the first to third postoperative weeks and no longer present 5 or 6 weeks thereafter. (auth)

20002 RADIOISOTOPE THERAPY OF MALIGNANT BONE DISEASES. Firusian, N.; Schmidt, C. G. (Univ., Essen). Nucl.-Med., Suppl.; No. 12, 626-631(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

In 10 patients with solid tumors and systemic illnesses resulting in generalized involvement of the skeleton, ^{89}Sr therapy was carried out after exhaustion of all other methods of therapy. In 8 of the patients there was an impressive clinical remission after administration of from 0.015 to 0.02 mCi ^{89}Sr/kg. The simultaneously observed increase of the alkaline phosphatase was explained as activation of the osteoblasts and as reactivation of the osteoid boundary zones. The indications for this type of therapy are outlined. (tr-auth)

20003 PROGRESS OBSERVATIONS IN MALIGNANT MELANOMA AFTER ENDOLYMPHATIC RADIONUCLIDE TREATMENT. Gehring, D.; Pauli-Beisel, C.; Baumeister, L.; Kayma, U.; Hoffmann, G. (Univ., Freiburg i. B.). Nucl.-Med., Suppl.; No. 12, 635-638(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Follow-up observations on 67 patients with malignant melanoma who were treated with endolymphatic radionuclide therapy after surgical removal of the primary tumor of the lower extremities are reported. The first 9 patients received ^{131}I-labelled compounds and the others received ^{32}P-labelled compounds. Of the 35 patients without detectable metastases at the time of the lymphography, none died up to more than five years after therapy. In the group of patients with detectable metastases, 23 died and the mean survival time was calculated as 2.3 years. (JSR)

20004 ADDITIONAL RADIATION DOSE IN PATIENTS DUE TO RADIOACTIVE IMPURITIES IN RADIONUCLIDE GENERATORS. Herzberg, B.; Kaul, A.; Meinhold, H.; Roedler, H. D. (Freie Univ., Berlin). Nucl.-Med., Suppl.; No. 12, 639-642(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The analysis of radioactive contaminants in eluates of ^{99}Mo/^{99m}Tc-generators revealed the presence of ^{134}Cs, ^{89}Zr, and ^{86}Rb, or occasionally of ^{110m}Ag. Referred to 1 mCi ^{99m}Tc the total maximum activity of these radiocontaminants is approximately 70 nCi corresponding to less than 0.01%. This value is in agreement with the limit of 0.01% as recommended by the AEC for radionuclidic impurities. Even in cases of considerable breakthrough of ^{99}Mo the corresponding AEC limit of 0.1% was not exceeded. The additional absorbed dose from radionuclidic impurities or from ^{99}Mo breakthrough may reach 20% or 70%, respectively, of the absorbed dose from the pure generator radionuclides. (auth)

20005 TREATMENT OF HYPERTHYROIDISM WITH RADIOACTIVE IODINE. Bell, R. L. (Park View Hospital, Nashville). J. Tenn. Med. Assoc.; 67: 568-570(Jul 1974).

While radioactive iodine is clearly the therapy of choice for Graves' disease (even in younger patients) the use of radioactive iodine for therapy of the toxic multinodular or uninodular goiter presents an entirely different problem. Although these two entities can be treated with radioactive iodine provided there is some suppression of the tissue that is not autonomous, transient release of thyroid hormone may induce symptoms of thyroid storm in the very large multinodular toxic goiter treated with radioiodine therapy. These toxic nodules generally require much larger doses of radioiodine than is commonly used for classical Graves' disease and may either require fractional administration of radioisotopes or concomitant use of antithyroid drugs and iodides. In general, surgery remains the treatment of choice for large toxic multinodular goiters, after proper preparation by medical means including radioactive iodine. Radioactive iodine therapy for hyperthyroidism is contraindicated in pregnancy and generally is not used in children below five years of age. (auth)

Animals

Refer also to abstract 19731.

20006 UNIMPAIRED FERTILIZATION WITH THYMIDINE-^3H-LABELLED SPERMATOZOA IN THE MOUSE. Kopecny, V.; Pavlok, A.; Koefoed-Johnsen, H. H.; Fulka, J. (Inst. of Animal Physiology and Genetics, Libechov, Czech.). Folia Biol. (Prague); 21: No. 3, 176-183(1975).

Thymidine-^3H-labelled spermatozoa were obtained in the sixth week after injection of males with a single or repeated doses of thymidine-^3H, in amounts of 3.5 to 50 μCi per gram body weight. Mouse ova were fertilized in vivo or in vitro by such labelled spermatozoa. It was found by means of autoradiography that heavily labelled spermatozoa compete successfully with non-labelled ones in performing fertilization. The distribution of relative levels of activity in fertilizing spermatozoa was similar to that in the population of inseminated spermatozoa. The early development of ova fertilized by generally labelled spermatozoa (followed up to the first cleavage) was not impaired. It is concluded that spermatozoa labelled with thymidine-^3H in their DNA to a level sufficient for autoradiographic detection may be probably used in the studies of the cytology of fertilization with greater precautions regarding possible radiation-induced artefacts. (auth)

20007 RADIATION DOSAGE IN METABOLIC INVESTIGATIONS ON AVIAN THYROID GLANDS. Stiller, K. J.; Robiller, F. (Friedrich-Schiller-University, Jena, Germany). Exp. Pathol.; 9: No. 5/6, 374-376(1974).

Metabolic investigations by means of ^{131}I involve considerable radiation doses owing to the concentration of ^{131}I. This radiation stress does not lead to changes in the thyroid demonstrable by light microscopy. Also on the substructural level no alterations of the single cells can be observed. Thus the thyroid gland of the budgerigar proves to be an extremely radioresistant organ. (auth)

20008 LOCALISATION OF PLUTONIUM IN MOUSE TESTES. Green, D.; Howells, G. R.; Humphreys, E. R.; Vennart, J. (Medical Research Council, Harwell, Eng.). Nature (London).; 225: No. 5503, 77(1 May 1975).

Inhomogeneity of distribution of Pu within gonads has been noted, giving rise to the possibility that some cells may receive a greater radiation dose than others. Some studies are reported using mice, that indicate increased radiation to the spermatogonial stem cells due to non-uniform distribution of ^{239}Pu in the testis. The ^{239}Pu was injected intravenously as citrate. Most of the Pu appeared to be deposited within the intertubular spaces and in the surrounding peritubular tissue. The results showed that the dose rate to the stem cells was greater by a factor of 2 to 2.5 than the average for the testis, implying that the genetic effects may be proportionately greater. (UK)

Plants

Refer also to abstract 20042.

Nuclide Kinetics and Toxicology

Man

Refer also to abstracts 19939, 19998, 20057, 20115, 20127, 20132, 20140, 20144, and 21346.

20009 (FRNC-TH-527) QUANTITATIVE STUDY OF THE FIXATION OF RADIOACTIVE ISOTOPES IN THE ORGANISM. Aubert, B. (Toulouse-3 Univ., 31 (France)). 1974. 165p. (In French). Dep. NTIS (US Sales Only) $11.25.

Thesis.

A new method is described for measurement of radioisotope uptake in organs. Such methods have to face difficulties in counting zone definition and in error estimation for adjacent tissues activity and variations in organ depth and thickness. The method presented here minimize these errors. It is based on the automatic computer processing of numerical scintigrams and was developed with simulated scintigrams and with fantom scintigrams. It can be applied to any organ and any radionuclide when the measurement conditions are adequate. An example of application given is ^{99m}Tc uptake in the thyroid. (CH)

20010 A PRELIMINARY STUDY OF IRON ABSORPTION BY WHOLE BODY COUNTING AND CORRELATION WITH DFO EXCRETION. Gupta, M. M.; Bhattacharyya, L.; Gupta, N. K.; Bhola, G. C.; Nagaratnam, A. (Institute of Nuclear Medicine and Allied Sciences, Delhi (India)); Manchanda, R.; Bhargva, M.; Kumar, S. (Lady Hardinge Medical Coll., New Delhi (India)). Nucl.-Med.; 14: No. 1, 74-80(1975).

2 tabs.; 26 refs.

A preliminary study of iron absorption by oral administration of ^{59}Fe and whole-body counting was carried out on a group of 16 women. The cases included 8 patients suffering from iron deficiency anaemia and various infections as well as 8 healthy controls. High iron absorption is associated with iron deficiency, these changes being more marked in iron deficient controls than in those with infection or malignancy. In iron deficient controls results of whole-body counting correlate very well with other haematological investigations. (auth)

20011 PLUTONIUM: TOXICITY AND DISTRIBUTION. Nachr. Chem. Tech.; 22: No. 19, 411-412(Oct 1974). (In German).

1 tab.; 2 refs.

For the isotope 239(238,240) of the most dangerous and toxic regarded element today, Pu, the maximum permissible concentration, the most effective counter agent for the detoxication of "soluble" Pu, DTPA, the effect of "unsoluble" Pu as dust particles, the controversy about A. R. Tamplin/T. B. Cochran

(1974), the distribution in the ground, the large area decontaminations after two plane crashes destroying atom bombs (Palomares 1966, Thule 1968), various laboratory accidents, plant, animal, and human intake, and future production of Pu (fast breeder, light water reactor) are discussed. (GE)

20012 EVOLUTION OF THE RESIDUAL ACTIVITY OF THE BRAIN AFTER INJECTION OF A SOLUTION OF ^{167}Yb-DTPA IN THE CEREBROSPINAL LIQUID. de Tovar, G.; Koutoulidis, C.; Beaufils, F.; Collonge, M.; Zerbib, J. C.; Imbert, L.; Bonleu, M.; Joffre, H. (CEN, Saclay, France). Nucl.-Med., Suppl.; No. 12, 121-126(1974). (In French).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The observation of a higher retention of ^{167}Yb-DTPA than that previously reported led to a determination of the evolution of the residual activity of the brain after injection of this labelled compound. The methods used in phantom and patient measurements in the evaluation of the activity, elimination of ^{169}Yb-DTPA by the organism, and measurement of the absorbed dose are described. The measurements show that the elimination is only 70 to 80% of the injected activity instead of the 95 to 97% previously reported. Possible mechanisms for the ^{167}Yb retention are discussed. (JSR)

20013 IODINE UPTAKE OF THE THYROID AFTER INTRAVENOUS INJECTION OF TRH. Oberhausen, E.; Gloebel, B.; Berberich, R. (Univ., Homburg, Ger.). Nucl.-Med., Suppl.; No. 12, 156-158(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The absolute iodine uptake of the thyroid and the thyroxin secretion rate were measured in eight persons with normal thyroids. The results obtained are tabulated and show that the iodide clearance and the absolute iodide uptake are not affected by TRH injection up to 3 hrs after injection. The biological half-life of thyroxin does not change. Small, but measurable, variations in the serum concentration of T_4 and its distribution volume are found. A sharp increase in the T_4 secretion by the thyroid was observed after TRH injection. (JSR)

20014 COMPARISON OF METHODS FOR ACCELERATING THE ELIMINATION OF RADIOACTIVE IODINE FROM THE THYROID AND THE BODY. Malamos, B.; Koutras, D. A.; Livadas, D. P.; Sfontouris, J. (Alexandra Hospital, Athens). Nucl.-Med., Suppl.; No. 12, 166-168(1974).

From 11th international meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Methods are outlined for stimulating the excretion of ^{131}I from the thyroid and whole-body of patients. The most marked excretion was obtained by the combined administration of carbimazole and TSH. (CH)

20015 EFFECT OF THE THYREOTROPIN-RELEASING HORMONE (TRH) ON THE RADIOIODINE UPTAKE BY THE THYROID GLAND. Gasiorowski, W.; Wojciechowski, J.; Krzeminska, T. Endokrinol. Pol.; 26: No. 2, 169-174(1975).

The increase in serum thyroid-stimulating-hormone (TSH) levels recorded twenty and sixty minutes after the intravenous administration of 200 μg of synthetic releasing hormone (TRH) can be used as a test of thyroid function. It is suggested that lack of the response to TRH may be a sensitive index of the thyrotoxic state. The radioiodine uptake by the thyroid gland was estimated after intravenous administration of 200 μg of synthetic thyrotropin-releasing hormone TRH—Hoechst in 34 persons (12 healthy and 22 with thyroid disorders). The test was performed using ^{123}I and ^{131}I preparations. The mean ^{123}I and ^{131}I thyroid uptake rose distinctly after 3 hours both in healthy persons and in patients with thyroid disorders (diffuse and nodular non-toxic goiter, autonomous thyroid nodules toxic and non-toxic, and Graves' disease). In the later examination (after 6 and 24 hours) the thyroid uptake remained unchanged. The possible explanation of this phenomenon is, that i. v. administration of 200 μg of the TRH releases only such quantity of TSH that has a brief and early influence on the radioiodine uptake by the thyroid. (auth)

Animals

Refer also to abstracts 19755, 19759, 19760, 20125, 20131, 20133, 20141, 20145, and 20368.

20016 (BNWL-SA-5170) DISPOSITION OF HIGHLY TOXIC RADIOACTIVE AEROSOLS INHALED BY BEAGLE DOGS. Craig, D. K.; Decker, J. R.; Powers, G. J.; Park, J. F. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1975. Contract AT(45-1)-1830. 20p. (CONF-750707-2). Dep. NTIS $4.00.

From annual meeting of the Health Physics Society; Buffalo, New York, USA (13 Jul 1975).

Beagle dogs were exposed to ^{241}Am or ^{244}Cm oxides in an apparatus which permitted separation of expired from inspired air and measurement of these volumes, the aerosol concentrations, and their size distributions. Following exposure, excreta were collected and analyzed for 30 days and for a week prior to sacrifice. Activity in the lungs was estimated from periodic thorax counts, while complete tissue analyses were conducted on groups of 3 dogs sacrificed 10, 30, 90, and 270 days postexposure. Indications from the early thorax counts, excreta, and tissue analyses showed that ^{244}CmO/sub x/ aerosols having AMAD equals 0.5 mu m and GSD equals 2.1, initial alveolar deposition varied from 40 percent for the low level (10 nCi) to 20 percent for the high level (400 nCi); after early ciliary clearance, as much ^{244}Cm was excreted in the urine as in the feces; at 10 days postexposure, 25 to 35 percent was still in the lung with 45 to 65 percent in other soft tissues and 10 to 30 percent in the skeleton. For $^{241}AmO_2$, the size distribution was a function of aerosol concentration, with AMAD equals 0.7 mu m and GSD equals 2.4 at the low level (1 nCi), increasing to 1.35 mu m and 1.7 at intermediate levels (125 nCi), and 1.45 mu m and 1.7 at the high level (1150 nCi); corresponding mean alveolar depositions were 15, 30, and 35 percent. The ^{241}Am or ^{244}Cm tissue distribution analyses at various times post-exposure showed that both isotopes are readily translocated from the lungs to liver, skeleton, and muscle, ^{244}Cm twice as rapidly as ^{241}Am. (auth)

20017 (BNWL-SA-5296) INFLUENCE OF INHALED Ca-DTPA ON THE LONG-TERM EFFECTS OF INHALED Pu NITRATE. Ballou, J. E.; Dagle, G. E.; McDonald, K. E.; Buschbom, R. L. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1975. Contract AT(45-1)-1830. 15p. (CONF-750707-4). Dep. NTIS $4.00.

From annual meeting of the Health Physics Society; Buffalo, New York, USA (13 Jul 1975).

Inhaled Ca-DTPA administered to rats in 6 weekly, one-hour treatments of 3 mg/rat did not affect weight gain or life-span compared to Pu burdened animals (78 nCi ILB) or nontreated controls. In addition, the drug did not appear to promote the development of malignant lung tumors and bone tumors in Pu burdened rats although one rat exposed only to Ca-DTPA aerosols did develop a malignant lung tumor. This single lung tumor can not be considered significant although the normal incidence of this lesion is quite low. Inhaled Ca-DTPA therapy administered 20 days after Pu inhalation showed little effect in reducing the lung burden of plutonium. Skeletal deposition was decreased possibly because Ca-DTPA was administered during a time of active translocation of the inhaled Pu when Pu may have been available for chelation in the blood. Inhaled Ca-DTPA therapy did not appear to be beneficial in reducing the number of malignant lung tumors or bone tumors in plutonium burdened rats but on the other hand the chelate did not appear to promote these lesions. (auth)

20018 (ORNL-tr-4005) EFFECT OF VALENCY AND TYPE OF ^{239}Pu CHEMICAL COMPOUND ON ITS DISTRIBUTION IN THE BODY. Khalturin, G. V.; Sevostiyanova, E. P.; Zhuravleva, A. K.; Buldakov, L. A. Translated from Gig. Sanit.; No. 5, 38-42(1974). 7p. Dep. NTIS $4.00.

Results are reported from studies on the tissue distribution of ^{239}Pu in rats following intravenous administration of tracer amounts as nitrates of Pu(III) pH 2.5, Pu(V) pH 2.75, or Pu(VI) pH 6.5; oxalates of Pu(IV) pH 6.5 or Pu(VI) pH 6.5; or citrates of Pu(III) pH 2.5, Pu(IV) pH 6.5, Pu(VI) pH 6.5; or citrate of polymerized Pu(IV) pH 6.5. The content of Pu in blood, skeleton, liver, spleen, and kidneys was measured at 10—15 min, 1 hr, 1 day, and 7 days following injection. (CH)

20019 RETENTION OF ^{241}Am IN RATS AND SYRIAN HAMSTERS. Seidel, A. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Strahlenbiologie). Strahlentherapie; 149: No. 4, 442-446(Apr 1975). (In German).

5 figs.; 3 tabs.

The retention of ^{241}Am during the first 3 months after injection and the autoradiographic microdistribution of the radionuclide on the 2nd day were studied in rats and Syrian hamsters. Deposition, retention, and microdistribution in the skeleton were the same for both species. Apart from a higher initial deposition in hamsters, the same applies to the kidney. The microdistribution of ^{241}Am in kidney and liver is diffuse for both species, with a marked accumulation in the renal cortex. A significant difference is noticed in the elimination of ^{241}Am from the liver: Most of the ^{241}Am is eliminated in a half-life period of about 7 days by the rat, while the half-life period is about 150 days for the hamster. The relevance of the difference between the species is discussed. (GE)

20020 DISTRIBUTION OF ^{125}I-GASTRIN IN THE RAT. Berger, L.; Kamenisch, W.; Rapti, S.; Pfeiffer, E. F. (Univ., Ulm, Ger.). Nucl.-Med., Suppl.; No. 12, 509-513(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

^{125}I-gastrin was injected into rats. After wash-out of the blood, the organs were removed and the radioactivity was determined. The kidneys have the most radioactivity/mg of organ of all the organs tested, whereas no increase of radioactivity was detected in the liver. The 50% disappearance rate of ^{125}I was determined as 6 min. In animals with ligature of the kidney vessels this value is significantly lengthened. (tr-auth)

20021 ROLE OF BACTERIA IN BIOACCUMULATION OF MERCURY IN THE OYSTER CRASSOSTREA VIRGINICA. Sayler, G. S.; Nelson, J. D. Jr.; Colwell, R. R. (Univ. of Maryland, College Park). Appl. Microbiol.; 30: No. 1, 91-96(Jul 1975).

An investigation of mercury-resistant bacteria was undertaken to determine their role in the accumulation of mercury in a simplified food chain. Oysters (Crassostrea virginica) were maintained in a closed system, sealed aquarium with stirred, aerated water containing 10 mu g of $^{203}HgCl_2$ per liter. Uptake of ^{203}Hg by oysters held under control conditions was compared with that of ^{203}Hg uptake by oysters under similar conditions except that mercury-accumulating and mercury-metabolizing species of Pseudomonas, isolated from Chesapeake Bay, were added to the experimental oysters. After incubation for 4 days, the major portion of the ^{203}Hg in the water column was found to be associated with the microparticulate fraction, corresponding to a rise in total viable count. Mercury accumulation in the oysters was significantly higher in the gill and fisceral tissue than other tissues. Mercury concentrations were 200 times greater in tissue fractions of oysters dosed with mercury-metabolizing bacteria compared with the oysters held under control conditions without mercury-metabolizing bacteria. (auth)

20022 MILK SECRETION OF INORGANIC MERCURY IN LACTATING GOATS. Nishimura, Y.; Matsusaka, N.; Yuyama, A. (Iwate Univ., Morioka (Japan). Faculty of Agriculture). J. Radiat. Res.; 15: No. 4, 176-180(Dec 1974).

Three lactating goats were administered with a single dose of 1 mCi of ^{203}Hg intravenously. The ^{203}Hg concentration in the blood and milk, and its excretion rate in urine and feces, were investigated. The ^{203}Hg concentration in the whole blood was 5.5×10^{-3}% of dose/g 1 hr after administration and decreased with time to 5.0×10^{-5}% of dose/g 21 days after administration. On the other hand, the concentration in the milk reached a peak value of 5.7×10^{-4}% of dose/g 5 hrs after administration, followed by a gradual decrease to 5.0×10^{-6}% of dose/g 21 days after administration. The ^{203}Hg concentration in the blood serum was higher than that in the red blood cells until the initial 5 hrs after administration. This relation was reversed thereafter. The ^{203}Hg concentration in the milk casein was higher than that in the whey. The milk casein showed a peak value of 1.2×10^{-3}% of dose/g at 5 hrs after administration. The cumulative amounts of ^{203}Hg discharged in the milk, and in the urine and feces for 21 days after administration, were about 0.9, 12, and 30% of dose, respectively. The biological half-life of ^{203}Hg in these goats was estimated to 26 days. (auth)

20023 ELECTRON DIFFRACTION STUDY OF PLUTONIUM OXIDE PARTICULATES IN DOG LYMPH TISSUE. Hillyer, R. F.; Dagle, G. E. (Dow Chemical U.S.A., Golden, CO). Contract AT(29-1)-1106. pp 197-205 of Microstructural Science. Volume 2. Fritzke, G. P. (ed.). New York; American Elsevier Publishing Company, Inc. (1974).

From sixth meeting of International Metallographic Society of America; Los Angeles, California, USA (25 Sep 1973). See CONF-730973-.

Popliteal lymph-node sections from Beagle dogs were examined with the electron microscope in order to define localized particulates. By means of autoradiography, particulates in the lymph tissue had been determined previously to be alpha emitters (radioactive). However, with electron diffraction, the particulates have been identified as plutonium oxide (PuO_2). (auth)

Plants

20024 (ORNL-EIS-75-77) RADIONUCLIDE MOVEMENT IN SOILS AND UPTAKE BY PLANTS. A Selected, Annotated Bibliography. Francis, C. W.; Talmage, S. S.; McMullin, B. B. (Oak Ridge National Lab., Tenn. (USA)). Aug 1975. 371p. Dep. NTIS $21.75.

This bibliography covers the world literature from 1948 to 1975 and contains 1397 references to information on how various chemical, physical, and biological factors influence the movement of radionuclides in soil and uptake by plants. Much of the data is related to the major fission products in radioactive fallout, with emphasis on ^{137}Cs and ^{90}Sr. References are included to data on nearly all fission products, a large number of biologically important activation products, and various naturally occurring radioactive nuclides such as uranium and thorium. Subject, author, geographic location, taxon, and permuted title indexes are included. (CH)

New Tracer Techniques

Refer also to abstracts 19389, 19390, 19394, 19400, 19790–19794, 19911, 19997, 19998, 20004, 20009, 20010, 20012, and 20014.

20025 (CEA-CONF-2959) TUMOR LOCALIZATION USING COMPOUNDS LABELLED WITH CYCLOTRON PRODUCED SHORT LIVED RADIONUCLIDES. Comar, D. (CEA, 91 - Orsay (France). Service Hospitalier Frederic Joliot). 1974. 11p. (CONF-741247-1). Dep. NTIS (US Sales Only) $4.00.

From consultant group for the study of the localization of tumors using radioactive agents; Vienna, Austria (9 Dec 1974).

The advantages of using compounds labeled with the cyclotron-produced short-lived radionuclides ^{15}O, ^{11}C, ^{13}N, and ^{18}F for scintiscanning patients for the localization of neoplasms are reviewed. (CH)

20026 (CONF-750465-1) RADIONUCLIDE COMPUTERIZED TOMOGRAPHY FOR BRAIN STUDY. Kuhl, D. E.; Edwards, R. Q.; Alavi, A.; Reivich, M.; Rothenberg, H. (Pennsylvania Univ., Philadelphia (USA). Dept. of Radiology). 16 Apr 1975. 23p. Dep. NTIS $4.25.

From workshop on reconstruction tomography in diagnostic radiology in nuclear medicine; San Juan, Puerto Rico (18 Apr 1975).

The diagnostic value of /99m/Tc-pertechnetate computerized tomographic brain scans for measurements of regional blood flow, blood volume, membrane permeability, and inflammation is discussed. (CH)

20027 (STI/DOC-10/167) DESIGN OF RADIOTRACER EXPERIMENTS IN MARINE BIOLOGICAL SYSTEMS. (International Atomic Energy Agency, Vienna (Austria)). 1975. 295p. IAEA $18.00.

This report was prepared by a panel of radioecologists actively engaged in laboratory and field studies of radionuclide cycling. Its aim is to bring into perspective the problems involved in designing radioecological experiments. The two major objectives of the report are to review previous laboratory and field methods critically in order to demonstrate why comparisons of many results are not possible, and to present, wherever possible, detailed procedures for performing experiments that will produce readily comparable data. (auth)

20028 (STI/PUB-389) TRACER STUDIES ON NON-PROTEIN NITROGEN FOR RUMINANTS II. Panel Proceedings Series. Proceedings of a Research Co-ordination Meeting and Panel Held in Vienna, 18–22 February 1974. (International Atomic Energy Agency, Vienna (Austria)). 1975. 214p. (CONF-740248-). IAEA $13.00.

The rational use of non-protein nitrogen sources as substitutes for true protein in ruminant diets requires a detailed knowledge of the factors that affect microbial protein synthesis in the rumen and the ability of microbial protein to supply amino acids for productive functions in the whole animal. Isotopic tracers using ^{144}Ce, ^{15}N, and ^{35}S are being used to great advantage in studying the factors that affect the fermentation rates and microbial growth because they are the most reliable, and in some cases the only, markers available by which the complex processes in the rumen can be quantitated. New developments in tracer techniques and their application in ruminant feeding are reported in the 19 papers presented. (auth)

20029 (TID-3319-S6) BIBLIOGRAPHY ON NUCLEAR MEDICINE. Volumes 28-30. (Energy Research and Development Administration, Oak Ridge, Tenn. (USA). Technical Information Center). Jul 1975. 379p. Dep. NTIS $10.60.

References to 3177 publications related to nuclear medicine announced in Nuclear Science Abstracts (NSA) volumes 28(July-Dec. 1973), 29(Jan-June 1974), and 30(July-Dec. 1974) are contained in this bibliography. Subject, report number, and personal author indexes are included. (CH)

20030 KINETICS OF BLOOD-TISSUE EXCHANGE OF TRACERS. Bassingthwaighte, J. B.; Safford, R. E.; Knopp, T. J.; Wanek, A. R. (Mayo Graduate School of Medicine, Rochester, Minnesota). pp 665-668 of Summer Computer Simulation Conference. Vol. I. La Jolla, CA; Simulation Councils, Inc. (1974).

From computer simulation conference; Houston, Texas, USA (9 Jul 1974). See CONF-740703-P2.

The tracer diffusion technique was used for obtaining estimates of myocardial capillary permeabilities. The analysis is extended to show that the slits between endothelial cells of the capillary membrane are probably more than 90 angstroms wide. Equations

are given to show precise quantitative information on the kinetics of transcapillary membrane exchange. (HLW)

20031 ANTIGEN-BINDING BY MURINE LYMPHOCYTES. Benfari, M. J. F. Boston, MA; Univ. of Boston Graduate School (1975). 253p. University Microfilms Order No. 75-12,238. Thesis (Ph. D.).

Murine lymphoid cells from animals immunized with bovine serum albumin (BSA) bind via receptors on their surfaces detectable quantities of antigen which can be measured by use of an in vitro equilibrium binding system which is described. This system involves mixture of radioactive antigen (^{125}I-Bovine Serum Albumin) with a suspension 10^8 cells, and determining the quantity of antigen bound to the cells by counting cells and media and the supernatant alone, and making appropriate subtractions. The number of antigen-binding cells was determined by rosette formation with antigen coated erythrocytes. The quantity of antigen bound was found to vary directly with the proportion of cells/ml. Both immune and non-immune lymphoid cells bound antigen, but immune lymphocytes bound 20 to 30 times more at peak capacity (approximately 10^5 molecules are bound per reactive lymphocyte). (Diss. Abstr. Int., B)

20032 BIOSYNTHESIS OF CHONDROITIN SULFATE PROTEINS. Pulse Labeling Experiments with Radiosulfate of Four Pools of Chondroitin Sulfate Proteins in Calf Rib Cartilage. Kleine, T. O.; Heinrich, B.; Goetz, K. (Klinisch-Chemisches Labor der Univ.-Nerv. Klinik, Marburg/Lahn, Ger.). FEBS (Fed. Eur. Biochem. Soc.) Lett.; 39: 255-258(1 Mar 1974).

Experiments with ^{35}S sulfate tracer gave evidence of the transfer of de novo synthesized metabolically and chemically heterogeneous ChS-P of an insoluble priming pool into three differently soluble, metabolically and chemically heterogeneous proteoglycan pools of the calf rib cartilage. (auth)

20033 DEVELOPMENT OF RADIOIMMUNOASSAYS FOR ANTICONVULSANT DRUGS. Robinson, J. D.; Morris, B. A.; Aherne, G. W.; Marks, V. (Univ. of Surrey, Guildford, Eng.). J. Endocrinol.; 64: No. 1, 7P-8P(Jan 1975).

The development of radioactively labelled forms of the anticonvulsant drugs sulthiame and phenytoin is described. In the case of sulthiame a label has been produced by conjugation of the drug to iodination, tyrosine methyl ester using the same techniques as were used to couple the drug to its carrier protein. The resulting complex has been radioiodinated by the chloramine-T method and the label checked for reactivity with serum samples from immunized animals. A high specific activity tritium-labelled phenytoin has been provided by Dr. Kepler, who prepared the labelled compound by reductive tritiation of the di-bromo salt of phenytoin. The radioimmunoassay has been used in a study of the pharmacokinetics of a single oral dose of phenytoin in five normal subjects. The results of this experiment indicate that two points of maximum concentration occur 3 and 10 h after administration. The overall half-life of the drug appears to be 9.75 h. (UK)

20034 SUMMER COMPUTER SIMULATION CONFERENCE. Volume II. Proceedings of the Conference Held at Houston, Texas, July 9–11, 1974. La Jolla, CA; Simulation Councils, Inc. (1974). 461p. (CONF-740703-P2). AFIPS Press, Montvale, NJ.

A separate abstract was prepared for one paper presented at the conference. An additional 126 papers were presented on various simulation studies in meteorological, biological, environmental, and physical sciences. (HLW)

For an abstract of an individual paper see: 20030.

20035 DIAGNOSTICS AND COURSE CONTROL OF THE ADRENOGENITAL SYNDROME TYPE 21-HYDROXYLASE DEFECT BY RADIOIMMUNOASSAY OF 17-α-HYDROXYPROGESTERONE. von Schnakenburg, K.; Bidlingmaier, F.; Knorr, D. (Kiel Univ. (F. R. Germany). Kinderklinik; Muenchen Univ. (F. R. Germany). Kinderklinik). Monatsschr. Kinderheilkd.; 122: No. 7, 622-623(Jul 1974). (In German).

2 refs.

A method of quick radioimmunologic determination of 17-OHP was developed. The antiserum was collected by means of immunisation of rabbits with a 17-OHP-C-3 protein conjugate and could be used in a 1 : 10,000 dilution without further preparation. Of the 20 steroids analyzed, only progesterone showed a remarkable cross-reaction. With the method described, 25 pg 17-OHP can be clearly distinguished from 0%. The degree of accuracy of the demonstration method was checked with two other methods. Until now, the 17-OHP plasma level of more than 40 patients with 21-hydroxylase defect has been determined with the method described by the authors. (GE)

20036 SOME ASPECTS OF THE RADIOPHARMACEUTICS OF ^{99m}Tc-PHYTATE. Sewatkar, A. B.; Noronha, O. P. D.; Ganatra, R. D.; Glenn, H. J. (Bhabha Atomic Research Centre, Bombay (India). Radiation Medicine Centre). Nucl.-Med.; 14: No. 1, 46-51(1975).

3 figs.; 2 tabs.; 5 refs.

This paper outlines the method of preparation of ^{99m}Tc-phytate and its use for scanning the reticuloendothelial system. The tissue distribution studies in mice and rats indicate that ^{99m}Tc-phytate is a safe and effective liver imaging agent. This was confirmed by preliminary studies in human subjects. The stability of the aqueous tin-phytate complex is remarkably good, and it could be successfully used for more than two months to prepare the labelled product. (auth)

20037 DETECTION OF NEOPLASTIC LESIONS WITH RADIOGALLIUM (^{67}Ga CITRATE). Clinical-Statistical Report on 125 Cases. Palermo, F.; Patrese, P. (Inst. of Radiotherapy and Nuclear Medicine, Treviso, Italy). Radiol. Clin. Biol.; 43: No. 6, 509-520(1974).

Gallium-67 citrate is used in scanning human neoplasms since it has a particular affinity for malignant proliferations in soft tissues. One hundred and twenty-five subjects, 98 with various types of malignancy and 27 with benign dysplastic, granulomatous, or inflammatory diseases, were examined. Serial scintiphotographic and scintigraphic recordings of areas with pronounced uptake of gallium were carried out within 72 h of its administration (or later). Agreement with histological data was ascertained in 75% of neoplastic and non-neoplastic patients; still such frequency, in relation to the whole of the observations, did not show an index high enough for statistical trustworthiness. If considered as limited to tumors of the lung, liver, mammary glands, and to lymphomas, gallium with the help of statistical data is shown to be a screening device between benign and malignant proliferations. (auth)

20038 EFFECTS OF MORPHINE ON KINETICS OF ^{14}C-DOPAMINE IN RAT STRIATAL SLICES. Celsen, B.; Kuschinsky, K. (Max-Planck-Institut fuer Experimentelle Medizin, Goettingen (F. R. Germany). Abt. Biochemische Pharmakologie). Naunyn-Schmiedebergs Arch. Pharmakol.; 284: No. 2, 159-165(1974).

1 fig.; 3 tabs.; 17 refs.

The uptake and release of ^{14}C-dopamine and the effect of morphine on these processes were studied in slices of rat striata. The uptake of the labeled dopamine was completed after 30 min. Low temperature, DNP and ouabain inhibited the accumulation of dopamine. Morphine (1.2 and 3.5×10^{-5} M) did not affect the uptake of labeled dopamine, but it slowed the K^+-induced release of ^{14}C-dopamine. Naloxone significantly inhibited this effect of morphine. Our results demonstrate a direct and specific action of morphine on dopaminergic neurons of rat brain. (auth)

20039 RADIOIMMUNOASSAY OF PLASMA ESTRADIOL-17 beta WITH THE USE OF POLYETHYLENE GLYCOL TO SEPARATE FREE AND ANTIBODY-BOUND HORMONE. Schiller, H. S.; Brammall, M. A. (Univ. of Washington, Seattle). 24: No. 5, 665-678(Nov 1974).

A radioimmunoassay for plasma estradiol-17 beta was developed using polyethylene glycol to separate free from antibody-bound hormone. Specificity for estradiol-17 beta was achieved by a modified celite microcolumn procedure in which estradiol was separated from interfering estrogens, including estrone. Using trace ^{3}H-estradiol to monitor procedural losses, the method was shown to be sensitive and accurate. Intra- and inter-assay coefficient of variation of the method was 8.7 and 10.6 percent, respectively. Polyethylene glycol used for antibody precipitation appears to be a generally applicable method for steroid hormone radioimmunoassays. The simplicity, precision, and rapid analysis, coupled with its lack of time dependence and ease in automation, makes this a convenient and practical method. (auth)

20040 SPECIFIC ANTISERA SUITABLE FOR SOLID-PHASE RADIOIMMUNOASSAY OF 11 beta-hydroxyandrost-4-ene-3,17-DIONE. Narasimha Rao, P.; Moore, P. H. Jr.; Goldzieher, J. W. (Southwest Foundation for Research and Education, San Antonio). Steroids.; 24: No. 6, 793-801(Dec 1974).

Specific antiserum was developed for use in measuring 11 beta-hydroxyandrost-4-ene-3,17-dione by radioimmunoassay (RIA). Rabbit antiserum was generated by employing the conjugate prepared by coupling 6 beta,11 beta-dihydroxyandrost-4-ene-3,17-dione 6-hemisuccinate with bovine serum albumin. The antiserum bound 68 percent of 50 picograms of 11 beta-hydroxyandrost-4-ene-3,17-dione-[1,2,6,7-^{3}H] during characterization at a dilution of 1:12,500. Among the numerous steroids tested for cross-reactivity, 5 alpha-androstane-3,17-dione, androst-4-ene-3,17-dione, and 11 beta-hydroxy-5 alpha-androstane-3,17-dione showed 2 percent, 5 percent, and 30 percent cross-reactivity respectively. The Rivanol-treated antiserum was coupled to Enzacryl AA, in order to study the feasibility of a solid-phase RIA, and

this complex showed 50 percent binding with the labeled antigen at a dilution of 1:3000. The complex retained high specificity and should prove useful in a simple solid-phase RIA. (auth)

20041 TRACE ANALYSIS OF ECDYSONES BY GAS-LIQUID CHROMATOGRAPHY, RADIOIMMUNOASSAY, AND BIOASSAY. Borst, D. W.; O'Conner, J. D. (Univ. of California, Los Angeles). Steroids.; 24: No. 5, 637-656(Nov 1974).

A radioimmunoassay was compared to a gas-liquid chromatographic assay and a bioassay as a method for quantifying ecdysone titers in arthropods. In addition a continuous-development thin layer chromatographic technique was evaluated as a means for separating various ecdysone analogues. The carboxymethoxyamine derivative of beta-ecdysone was synthesized and characterized by several spectral methods. This derivative was conjugated to bovine serum albumin to afford a suitable antigen and injected into rabbits. The antisera produced shows a moderate affinity for beta-ecdysone and cross-reacts with many ecdysone analogues. Ecdysones were also quantified directly as trimethylsilyl ethers using a ^{63}Ni electron capture detector in a gas-liquid chromatographic system. Less than 50 pg of material could be detected per injection. Both of these techniques and the Musca domestica bioassay were used for the comparative analysis of a number of biological samples. The advantages and disadvantages of the various methods are discussed. (auth)

20042 NUCLEAR MEDICINE: RESULTS IN TECHNIQUES, DIAGNOSIS, AND THERAPY. Eleventh International Annual Meeting of the German Society of Nuclear Medicine, September 24-29, 1973. Pabst, H. W. Nuclear Medicine, Supplement 12. Stuttgart; F. K. Schattauer Verlag GmbH (1974). 700p. (In Several Languages). (CONF-730944-). DM 133,-.

Separate abstracts were prepared for the 143 papers included. (CH)

For abstracts of individual papers see: 19789–19794, 19939, 19940, 19979, 19998–20004, 20012–20014, 20020, and 20043–20165.

20043 SOME EARLY AND RECENT EXPERIENCES IN NUCLEAR MEDICINE. Lawrence, J. H. (Univ. of California, Berkeley). Nucl.-Med., Suppl.; No. 12, XXIII-XLI(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Developments of diagnostic tracer techniques since 1923, when natural radioisotopes were first used as tracers, to the present widespread use of artificial radioisotopes, sophisticated counting equipment, and data processing techniques are reviewed. The need is stressed for more selectively localizing radiopharmaceuticals, especially for use for the early diagnosis of cancer as well as other pathological states. (75 references) (CH)

20044 VARIOUS DIGITAL EVALUATION METHODS FOR SCINTIGRAPHY. Lorenz, W. J.; Georgi, P.; Meder, H. G.; Walch, G.; Wiebelt, H. (Deutsche Krebsforschungszentrums, Heidelberg). Nucl.-Med., Suppl.; No. 12, 16-20(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

A brief review is given of filter and interactive methods and of a statistical test method (likelihood ratio test) developed in the last five years for the evaluation of scintigraphic results. (JSR)

20045 NEW CONCEPTS FOR DATA EVALUATION AND REPRESENTATION IN SCINTILLATION CHAMBERS. Linz, H. (GMBM, Mainz). Nucl.-Med., Suppl.; No. 12, 25-28(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

A commercially developed system for data processing and data display which is capable of evaluating complicated filter methods or function studies in cardiography is briefly described. The system is based on the concept of dividing the evaluation into two parts. The first group consists of all common programs for image improvement. The second group contains programs which are determined by the individual needs and methods of the user. (JSR)

20046 HIGHLY AUTOMATED EVALUATION OF RENAL FUNCTION STUDIES IN CLINICAL ROUTINE BY MEANS OF A SCINTILLATION CAMERA AND A DATA ACQUISITION SYSTEM. Lange, D.; Schenck, P.; Guertler, K. F.; Mueller, S. (Univ., Heidelberg). Nucl.-Med., Suppl.; No. 12, 48-53(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

A method is described for evaluating quantitative results in kidney examinations in a short enough time to be done during clinical routine. As a normal examination takes between 20 and 30 min., two patients are examined simultaneously by two scintillation cameras which are both connected to the system Hewlett Packard 5407 A. (HLW)

20047 QUANTITATIVE SECTION SCANNING IN EVALUATION OF LOCAL CEREBRAL VASCULATURE. Kuhl, D. E.; Reivich, M.; Edwards, R. Q. (Univ. of Pennsylvania, Philadelphia). Nucl.-Med., Suppl.; No. 12, 54-56(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

In transverse section scanning radiation detectors are moved in a sequence of tangential scans at regular angular intervals around the patient to view any radioactive structure in the selected cross-section from many different directions. The cross-section picture is then reconstructed from these data. Section scanning was used to complement the basic four-view rectilinear study in selected patients, and to clarify the diagnosis in regions in which disease is suspected on the basis of history or the results of the initial scan. (HLW)

20048 CLINICAL EVALUATION OF BRAIN SCANS WITH DIGITAL COMPUTER ANALYSIS APPLICATION OF DIFFERENT FILTERS. Teijeiro, J.; Martinez-Alonso, R.; Zunzunegui, V.; Manrique, A.; Chamorro, J. L.; Arnaiz, F.; Embuena, A.; Ortiz-Berrocal, J. (Univ. Autonoma, Madrid). Nucl.-Med., Suppl.; No. 12, 57-61(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Differential diagnosis of brain lesions can be made by recording sequential images or by determining differences of uptake in several kinds of lesions. Computers are used to quantify exactly the concentrations of the tracer in the suspected focus, to compare the obtained value to the normal patterns, and to analyze quantitatively the differences of concentration in several areas of the brain. Computers are used for studying different pathological foci detected by gamma cameras. After the final diagnosis is made, data are obtained for making differential diagnosis among three groups of brain diseases; primary tumors, metastatic tumors, and vascular diseases. (HLW)

20049 COMPARISON OF VARIOUS QUANTITATIVE EVALUATION PARAMETERS OF NUCLEAR MEDICINE LUNG FUNCTION DIAGNOSIS. Bofilias, I.; Langhammer, H.; Hoer, G.; Lichte, H.; Pabst, H. W. (Technische Univ., Munich). Nucl.-Med., Suppl.; No. 12, 62-67(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

A nuclear medical technique was described in which the single breath phase, the equilibrium phase, and the wash-out phase and the half life of ^{133}Xe in the lungs can be determined in lung function diagnosis using inhalation of ^{133}Xe. The technique also included the determination of the percentage minute exhalation and the three-minute exhalation after injection of ^{133}Xe. Differential analysis of the exhalation kinetics in various respiratory illnesses is possible with this technique. (JSR)

20050 COMPUTER EVALUATION FOR DETERMINATION OF LOCAL VENTILATION-PERFUSION MAGNITUDES OF THE LUNGS IN COMPARISON WITH CLINICAL LUNG FUNCTION TESTS. Anger, K.; Feine, U.; Mueller-Schauenburg, W.; Krass, C.; Hilpert, P. (Univ., Tuebingen, Ger.). Nucl.-Med., Suppl.; No. 12, 68-72(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The procedure used in the computer evaluation of local ventilation-perfusion magnitudes in the lungs after injection of ^{133}Xe is outlined. The gas distribution is also determined in the procedure. The results obtained on 56 patients are compared with those obtained with clinical lung function tests. The evaluation showed that with the computer technique the various groups of lung diseases could be differentiated. No correlation was found between the type of respiratory illness and variations of the ^{133}Xe study, and the visual observation of the scintigram from the computer evaluation is of value in judging local disfunctions. (JSR)

20051 AUTORADIOGRAPHIC METHODS AND RESULTS IN CELL KINETICS. Maurer, W. (Univ., Wuerzburg, Ger.). Nucl.-Med., Suppl.; No. 12, 74-83(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

In the percent-labeled-mitoses-method animals receive a single injection of ^{3}H-thymidine that labels all cells in the DNA synthesis, or S, phase. When these labeled cells pass through successive mitoses peaks of labeled mitoses can be registered by counting the percentage of labeled mitoses on autoradiographs. The double labeling method is based on the labeling of interphase nuclei; the animals receive a first injection of ^{3}H-thymidine, and one or several hrs later a second injection of ^{14}C-thymidine. The labeling index is the percentage of labeled cells in short time experiments with ^{3}H-thymidine. From the relative number of S phase nuclei in a cell population and the duration of the S phase the cycle time can be calculated. The following cell kinetic studies are described: mode of growth of the epithelial crypt cells in the mouse jejunum; proliferation of neuroepithelial cells in the embryonic rat brain; and a quantitative model for the mouse liver regeneration after CCl_4 intoxication. (HLW)

20052 CELL KINETICS OF TUMORS AND PREREQUISITES FOR CYCLE SPECIFIC THERAPY. Schultze, B. (Univ., Wuerzburg, Ger.). Nucl.-Med., Suppl.; No. 12, 84-92(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Studies on characteristics of tumor growth are reviewed with regard to growth fraction and variability of the cycle time and its phases. Studies are also reviewed on cycle phase specific effect of cytotoxic drugs; prerequisites for a cycle phase specific therapy of human tumors; and scheme of therapy. (HLW)

20053 FIRST RESULTS WITH A DIVERGING TECHNETIUM COLLIMATOR (DIVCON-Tm). Frischauf, H.; Imhof, H.; Nowotny, R. (Medizinische Univ., Vienna). Nucl.-Med., Suppl.; No. 12, 94-99(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The first results obtained in phantom and clinical measurements with a collimator for energies up to 140 keV, which operates both in the diverging and converging mode, were reported and compared with results obtained with a diverging collimator for energies up to 410 keV. The results of liver scans, pancreas scintigraphy, thyroid scans, and regional myocardial blood flow are discussed. In 25 of the 74 patients examined better results were obtained with the diverging collimator. (JSR)

20054 RESEARCH IN THE DIFFERENTIAL DIAGNOSTICS OF INTRACRANIAL PROCESSES USING ^{75}Se-SODIUM SELENITE SCINTIGRAPHY. Steinhoff, H. (Univ., Munich). Nucl.-Med., Suppl.; No. 12, 106-111(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

On the basis of studies in 75 patients with intracerebral lesions the use of ^{75}Se-sodium selenite leads to a significant increase of the accurate differential diagnosis in cases where scintigraphy with ^{99m}Tc and carotid angiography gave positive but differentially unclear results. Its use when negative results are obtained with ^{99m}Tc does not give additional clarification. Because of the relatively high whole-body radiation burden resulting from the use of ^{75}Se-sodium selenite should not be used except in those cases where differential diagnosis can not be made with ^{99m}Tc. (JSR)

20055 VALUE OF BRAIN SCINTIGRAPHY FOR FLOW OBSERVATIONS AND RECIDIVITY DIAGNOSIS AFTER OPERATIONS FOR BRAIN TUMORS. Zeidler, U.; Weinrich, W.; Brunngraber, C. V.; Markakis, E. (Medizinische Hochschule, Hanover). Nucl.-Med., Suppl.; No. 12, 112-115(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The use of ^{99m}Tc scintigraphy in the detection of recurrence of brain tumors was evaluated on 105 patients who were also subjected to clinical diagnosis by neurophysiological and neuroradiological methods. The results showed that false negative findings are possible in the scintigraphy of stage I and II astrocytomas. Scintigraphy is a valid technique for the early detection of the recurrence of meningiomas. It is concluded that scintigraphy often gives an early warning of tumor recurrence. (JSR)

20056 ANGIOSCINTIGRAPHY IN SELECTIVE IMAGING OF THE EXTERNAL AND INTERNAL CAROTID ARTERY. Breit, A.; Reindl, P.; Schepke, P. (Staedtische Krankenbauses, Passau, Ger.). Nucl.-Med., Suppl.; No. 12, 116-120(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The technique used in the selective imaging is briefly outlined and the results obtained in three cases are reported. It is concluded that selective imaging using ^{99m}Tc micro- and macrospheres is a valuable auxiliary to angiography. (JSR)

20057 DATA OF CYSTERNOSCINTIGRAPHY. A Retrospective Study in 300 Patients. Piroth, H. D.; Glanzmann, C.; Rau, H.; Yonekawa, J. (Kantonsspital, Zurich). Nucl.-Med., Suppl.; No. 12, 127-129(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

On the basis of more than 300 myelocysternoscintigraphs, a classification was made on the basis of the distribution of ^{131}I-labelled human serum albumin (RIHSA). In the first group the activity maximum is found in the cerebrum convexity 24 hours after injection. The second group is subdivided into two classes: in the first the activity maximum is in the basal cysterns and in the second the maximum activity is like that in group 1 or group 2A, but with transitory maximum in the lateral ventricle up to 8 hrs post injection. In group 3, 24 to 48 hrs post injection there is activity in the lateral ventricle and the local counting rate in the cerebrum convexity is more than 30% of the intracerebral activity maximum. In group 4 up to 48 hrs post injection there is activity of the lateral ventricle, locally less than 30% of the intracranial maximum detectable over the cerebrum convexity. (JSR)

20058 THERMOGRAPHY OF THE THYROID. A Comparison of Thermography, Scintigraphy, and Cytology. Johne, M.; Wenzel, K. P.; Koppenhagen, K. (Freie Univ., Berlin). Nucl.-Med., Suppl.; No. 12, 130-132(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Thermography represents an important contribution to the differential diagnosis of scintigraphically cold nodes. Thermography permits, as a supplement to scintigraphy and cytology, an evaluation of the contralateral thyroid sides and of collective lymph node sites in the head-neck region. The combination of palpation findings, scintigraphy, and thermography with concurrent puncture of all scintigraphically cold and thermographically hot regions represent a sharply improved diagnostic concept. Predictions on later operative procedures can be made with greater accuracy. (tr-auth)

20059 COMPARISON OF THYROID SCINTIGRAMS MADE WITH THE GAMMA CAMERA AND RECTILINEAR SCANNER. van Vaerenbergh, P. M.; Tirnakli, V.; Schelstraete, K. (Univ. of Ghent). Nucl.-Med., Suppl.; No. 12, 133-136(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Results are compared of thyroid scans made with a γ camera and with a rectilinear scanner following the administration of a tracer dose of $^{99m}Tc\ O_4$ intravenously to 37 patients with various thyroid diseases. Scans of a thyroid phantom containing a movable $^{99m}Tc\ O_4$ point source were also made. The diagnostic advantages of camera scintigrams over scanner scans are discussed. (CH)

20060 DIAGNOSTIC VALUE OF ^{131}Cs SCANNING IN THYROID MALIGNANCY. Alevizaki, C. C.; Georgiadis, N.; Gonticas, S. C.; Ikkos, D. G.; Katsas, A.; Tsialas, S. (Evangelismus Hospital, Athens). Nucl.-Med., Suppl.; No. 12, 137-138(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Results are reported of ^{131}Cs thyroid scans of 40 patients performed two hours after a cold thyroid nodule was detected on routine ^{131}I scans. The results of the ^{131}Cs scans were compared with those of the ^{131}I scans and histological evaluations of excised tissues. Results showed that ^{131}Cs scans gave good results for the preoperative diagnosis of thyroid malignancy. (CH)

20061 THYROID SCANNING WITH ^{67}Ga AND ^{131}Cs. Koutras, D. A.; Pandos, P.; Sfontouris, J.; Koukoulommati-Spentza, A.; Malamos, B. (Alexandra Hospital, Athens). Nucl.-Med., Suppl.; No. 12, 139-140(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Results of thyroid scans using ^{67}Ga or ^{131}Cs as tracers are reported for a group of 46 patients in whom ^{131}I scans previously had shown a single thyroid nodule. The scan results were compared with histological evaluations of excised tissues. It was

concluded that neither ^{67}Ga or ^{131}Cs are very satisfactory for the preoperative diagnosis of thyroid malignancy. (CH)

20062 THYROIDAL UPTAKE OF $^{99m}TcO_4$ AND ITS SUPPRESSION BY TRIIODOTHYRONINE: AS ANALYZED BY SCINTILLATION CAMERA AND DATA PROCESSING SYSTEM. Lange, S.; Das, B. K.; Huethwohl, B. (Univ., Berlin). Nucl.-Med., Suppl.; No. 12, 141-144(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The value of the $^{99m}TcO_4$ thyroid uptake test following triiodothyronine suppression for the differential diagnosis of simple goiter and hyperthyroidism was evaluated in a group of patients previously examined by routine ^{131}I uptake test and blood analysis for thyroid hormone values. It was concluded that ^{99m}Tc uptake will not be able to replace the conventional ^{131}I uptake test and that a high degree of accuracy in the diagnosis of thyroid disorders can only be achieved by a series of tests and parameters, for which ^{99m}Tc uptake should prove useful when combined with blood analysis for thyroid hormones. (CH)

20063 ^{131}I-TRH FAST TEST IN HYPERTHYROIDISM AND ENDOCRINE OPHTHALMOPATHY. Wildmeister, W.; Herrmann, J.; Horster, F. A.; Krueskemper, H. L. (Univ., Dusseldorf). Nucl.-Med., Suppl.; No. 12, 145-147(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The stimulation of the secretion of thyrotropin (TSH) by synthetic thyrotropin releasing hormone (TRH) is detectable and can be used diagnostically in the TRH fast test. The results of the measurement of the uptake of ^{132}I before and after intravenous TRH injection in euthyroid, hyperthyroid, and endocrine ophthalmopathy were tabulated. The results show that the TRH fast test is a valid screening test for the evaluation of the hypothalamus-hypophysis-thyroid regulation area. In hypothalamic TRH insufficiency this test cannot be used. Thyroid hormones can inhibit the TRH stimulation. In other cases the TRH test is qualitatively comparable with the TRH-TSH test. (JSR)

20064 IS ^{131}I-TWO-PHASE TEST NECESSARY. Experiences With a ^{132}I-Two-Phase Rapid Test in Hyperthyroidism Diagnosis. Boerner, W.; Moll, E.; Schneider, H.; Ruppert, G.; Hartwig, H. (Univ., Wuerzburg, Ger.). Nucl.-Med., Suppl.; No. 12, 148-151 (1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The comparison of the ^{132}I-two-phase fast test with the ^{131}I-two-phase test and the ^{132}I-T_3 suppression test shows that comparable diagnostic results are obtained. The repetition of the test is only occasionally necessary. The radiation dose is reduced to a fiftieth of that received in the ^{131}I test. (JSR)

20065 APPLICATIONS OF T_3 AND T_4 TEST VALUES IN VARIOUS ANTICONCEPTIVE PREPARATIONS. Doepp, M.; Grebe, S. F.; Dietzel, F.; Roemer, M. (Univ., Giessen, Ger.). Nucl.-Med., Suppl.; No. 12, 152-155(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

In order to clarify to what extent the amount and type of estrogens and gestagens affect the T_3 and T_4 test values, 210 euthyroid patients taking oral contraceptives were studied. The results showed that the known effect of estrogen on the TBG is practically the same for all combination and single-phase preparations. There is a direct proportionality of the potency of the gestagens contained in each contraceptive and its capacity to modify the T_3 and T_4 test and to increase the bonding capacity of the TBG. (JSR)

20066 DECOMPENSATION OF AUTOMATIC ADENOMA OF THE THYROID AFTER PROLONGED IODINE ADMINISTRATION. Mahlstedt, J.; Joseph, K.; Schmidt, U. (Univ., Marburg, Ger.). Nucl.-Med., Suppl.; No. 12, 159-162(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

A study was made to evaluate the probability with which compensated autonomous adenomas are decompensated by introduction of a gall-seeking x-ray contrast medium iodobenzaminic acid. In the group of compensated autonomous adenomas treated with the acid there was a significant increase of the total thyroxin and of the T_3 in vitro tests. There was no change in the placebo group. In the control group there was a slightly significant increase of the hormone value 3 days after injection of the acid. In control scintigrams in 26 out of 27 patients there was a distribution pattern which corresponds to the scintigrams after suppression in the adenomas treated with the acid, whereas in the placebo group the same scintigraphic picture was obtained as before suppression. It is concluded from the sharp increase of the thyroid hormone concentration in the serum and the suppression-typical scintigrams after injection of the contrast medium that by protracted increase of the serum iodide level a decompensation of an initially compensated adenoma is the rule. (JSR)

20067 KINETICS OF THE THYROID HORMONE DURING PERTIONEAL DIALYSIS. Kallee, E.; Steinke, B.; Bischof, W.; Wahl, R.; Bohner, J. (Medizinische Univ., Tuebigen, Ger.). Nucl.-Med., Suppl.; No. 12, 163-165(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The elimination of ^{131}I-human serum albumin, T_4, and T_3 by peritoneal dialysis was studied in rabbits using two dialysis methods: one using an electrolyte solution alone and the other using it in combination with bovine serum. The results showed that more T_4 is eliminated by the combination method, but that in both methods the amount eliminated is disappointingly low. The elimination of human serum albumin followed a similar pattern. Even less T_3 was eliminated under both dialysis methods. (JSR)

20068 FUNCTIONAL SCINTIGRAPHY OF THE LUNGS. de Roo, M. J. K. (Katholieke Univ., Leuven, Belg.); Kiebooms, L.; Demedts, M.; Cosemans, J. Nucl.-Med., Suppl.; No. 12, 169-173 (1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The value of ^{133}Xe as a tracer for scintiscanning the lungs for the evaluation of ventilation and blood perfusion is discussed. Tissue distribution following intravenous injection of ^{133}Xe gives information on regional perfusion and the distribution following a single inhalation of ^{133}Xe from a spirometer gives information about regional ventilation. (CH)

20069 COMBINED $^{133}Xe^{99m}Tc$-MAP LUNG SCINTIGRAPHY: CRITERIA FOR THE OPERABILITY OF BRONCHIAL CARCINOMAS. Roesler, H.; Romas, M.; Merenda, C. (Univ., Bern). Nucl.-Med., Suppl.; No. 12, 174-178(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

For some years at the University Hospital in Bern ^{99m}Tc-macroaggregate perfusion scintigraphy of the lungs has been combined with sequence scintigraphy after intravenous injection of ^{133}Xe. The criteria used with this method for tumor staging as they are applicable to the evaluation of the operability of a bronchial carcinoma are described in detail. The results obtained after surgery showed that scintigraphic evaluation was correct 90% of the time. (JSR)

20070 FUNCTION-SCINTIGRAPHIC DETERMINATION OF THE RESIDUAL VOLUME AND COMPARISON WITH FOREIGN GAS DILUTION METHOD. Ingrisch, H.; Kantlehner, R.; Koehler, T.; Bergstermann, H.; Pfeifer, J.; Heinze, H. G. (Univ., Munich). Nucl.-Med., Suppl.; No. 12, 179-182(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

It was shown that residual volume determination is possible with nuclear medical methods using ^{133}Xe. A good correlation with the He foreign gas method is obtained ($r = 0.73$ and $p < 0.001$). One advantage is that the residual volume was measured in the framework of combined lung function scintigraphy with determination of the perfusion and ventilation distribution without additional burden to the patient. A second is that quantitative statements can be made on the laterally separated and regional ventilation by means of residual volume and total capacity determinations. (tr-auth)

20071 CARDIOVASCULAR NUCLEAR MEDICINE: A NEW APPROACH TO CORONARY HEART DISEASE, NON-INVASIVE TECHNIQUES. Strauss, H. W.; Wagner, H. N. Jr. (Johns Hopkins Medical Institution, Baltimore). Nucl.-Med., Suppl.; No. 12, 183-187(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The use of radioisotope tracer procedures to evaluate patients with coronary heart disease is evaluated. Emphasis is on the value of scintiscanning following the administration of ^{43}K or ^{81}Rb for the evaluation of myocardial infarction. (CH)

20072 ^{81}Rb USED AS A MYOCARDIUM IMAGING AGENT. Budinger, T. F.; Yano, Y.; McRae, J. (University of California, Berkeley). Nucl.-Med., Suppl.; No. 12, 188-192(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Rubidium-81 is a new myocardial imaging agent with an ideal $T_{\frac{1}{2}}$ of 4.6 hr and energies acceptable for gamma-camera viewing. The target-to-nontarget ratio for heart image to background in the projection images is usually less than 2 : 1, thus good statistics are necessary to delineate lesions. The low radiation dose and availability of this isotope allow one to obtain 6 to 10 times the data, and ^{81}Rb is probably superior to ^{129}Cs and ^{43}K for myocardial imaging if adequate collimation is present. (auth)

20073 CORRELATION OF ^{131}Cs MYOCARDIOSCINTIGRAPHY WITH CORONARY ANGIOGRAPHY, ANGIOSCINTIGRAPHY, AND MYOCARDIUM BLOOD FLOW. Kahn, P.; Heeger, H.; Aldor, E. (Hanuschkrankenhauses, Vienna). Nucl.-Med., Suppl.; No. 12, 193-197(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Cesium-131 myocardioscintigraphy can be used as a screening method which does not impose significant radiation burdens on the patients. It agrees in 59% of the cases with the other methods. False negative findings were obtained in 41% of the cases. (tr-auth)

20074 MEDICINAL MODIFICATION OF THE REGIONAL MYOCARDIUM BLOOD FLOW. Imhof, H.; Moesslacher, H.; Slany, J.; Umek, H. (Medizinische Univ., Vienna). Nucl.-Med., Suppl.; No. 12, 198-203(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The effect of dipyridamol, carbochromen, and a coronary-active research preparation Th-322 on the myocardial blood flow MBF was studied in two groups of patients using ^{133}Xe: the first group consisted of seven patients with angina complaints and normal coronary angiograms and the second group of nine patients with angina complaints and abnormal angiograms. In the first group there was a clear increase of the mean value of the MBF after injection of dipyridamol, but the increase was much less distinct in the second group. One patient treated with carbochromen showed a decrease of the MBF. There was also a decrease of the MBF after injection of Th-322. The causes for the decrease were discussed briefly. (JSR)

20075 PROCESS COMPUTER-CONTROLLED FUNCTION SCINTIGRAPHY OF THE HEART. Hundeshagen, H.; Jordan, K.; Sippel, R.; Geisler, S.; Dittmann, A. (Medizinische Hochschule, Hanover). Nucl.-Med., Suppl.; No. 12, 204-211(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The heart blood circulation parameters measurable with a scintillation counter with a small time constant, data processing, and phase-calculated control following the administration of radionuclide tracers are outlined. A flow diagram is given for the computer program for data acquisition and processing in radiocardiography. Results obtainable are illustrated and include images per heart contraction after injection, images obtainable with a filter, and time activity curves. (JSR)

20076 FUNCTION SCINTIGRAPHY OF THE HEART FOR THERAPY CONTROL IN PATIENTS AFTER HEART SURGERY. Breuel, H. P.; de Vivie, R.; Emrich, D. (Univ., Goettingen, Ger.). Nucl.-Med., Suppl.; No. 12, 212-214(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The results obtained in 11 patients followed by functional scintigraphy after heart surgery are briefly reported. All patients previous to surgery had a deviation of one or several parameters of the functional scintigram. The patients were examined at an interval of 2 weeks after surgery to 7 months later. In all but one patient there was a clear improvement of the clinical picture. A comparison is made of the variations in the clinical symptoms before and after surgery and in before-and-after functional scintigrams. This comparison shows that functional scintigraphy is a simple ambulatory method for the evaluation of therapy. (JSR)

20077 FUNCTION SCINTIGRAPHY OF CONTRACTIONS OF THE LEFT VENTRICLE. Emrich, D.; Luig, H.; Breuel, H. P.; Neubaur, J.; Strauer, B. E. (Univ., Goettingen, Ger.). Nucl.-Med., Suppl.; No. 12, 215-219(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The method used in the function scintigraphy of the left heart ventricle is described in some detail. The method is based on the use of ^{99m}Tc, an EKG-controlled autofluoroscope, and computer processing and reprocessing of the data. A typical summation curve of the transient activity pattern of the left ventricle during heart action is given. The initial results obtained in a pilot study on 21 patients (7 without heart disease) are discussed and compared with values obtained by angiocardiography. (JSR)

20078 MINIMUM CARDIAC TRANSIT TIME IN THE EFFORT SYNDROME, IN HYPERTHYRODISM AND HYPOTHYORDISM. Schicha, H.; Siebers, G.; Becker, V.; Vyska, K.; Feinendegen, L. E. (Kernforschungsanlage, Juelich, Ger.). Nucl.-Med., Suppl.; No. 12, 220-226(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

A method for the measurement of the minimum blood transit time of the heart is described in which the blood flow is followed by scintiscanning with ^{113m}In-DTPA. The results obtained in about 1200 studies show that the minimum transit times are affected both by the heart syndrome and by thyroid function. The shortened transit time following biological stress induced by exercise permits the defining of the extent of the initial myocardium disease. Hypothyroid states must be differentiated from myocardial disease; they induce a normal transit time after hormone administration when no supplementary irreversible myocardial damage has occurred. (JSR)

20079 MEASUREMENTS OF THE FLOW RATE OF THE BLOOD IN THE AORTA OF HUMANS: MINIMUM TRANSIT TIME IN HEALTHY PERSONS, IN LIMITED HEART FUNCTION, AND AORTA SCLEROSIS. Schicha, H.; Becker, V.; Vyska, K.; Feinendegen, L. E. (Kernforschungsanlage, Juelich, Ger.). Nucl.-Med., Suppl.; No. 12, 227-232(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

A diagnostic technique using ^{113m}In-DTPA as tracer for heart scintiscanning is described for the measurement of the minimum aorta transit time and the determination of the average flow rate of the blood. Results obtained in a study on 144 patients, 62 of whom were healthy, are reported and a highly significant linear correlation was found between the flow rate and heart rate. Regression lines of this relation were obtained for healthy persons, hyperkinetic heart syndrome, latent and manifest heart insufficiency, and pure aorta sclerosis. The simultaneous measurement of the aorta transit time and the minimum cardiac transit time gave a differential diagnosis with respect to a cardiac or vascular origin of altered flow rates. (JSR)

20080 INFORMATION VALUE OF GAMMA CAVOGRAPHY AND ITS INDICATORS. Kerkmann, D.; Huelse, R.; Wolf, R.; Grimm, W.; Manczak, G.; Mann, S.; Zeitler, E. (Univ., Mainz). Nucl.-Med., Suppl.; No. 12, 233-236(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

A scintigraphic technique using a gamma camera for the dynamic study of blood flow in the Vena cave using either $^{99m}TcO_4$ or ^{99m}Tc-Fe complex injected simultaneously on both sides in a dorsal vein is described. The results obtained in a study of 34 patients are summarized. The indications for the use of this technique, which should be considered as a supplement to angiography, are tabulated. (JSR)

20081 INTRAVENOUS PERFUSION SERIES SCINTIGRAPHY, RADIONUCLIDE ANGIOGRAPHY, IN THE DIAGNOSIS OF ARTERIAL BLOOD FLOW MALFUNCTIONS. Heidenreich, P.; Kempken, K.; Hoer, G.; Fischer, M.; Bonke, S.; Pabst, H. W. (Technische Univ., Munich). Nucl.-Med., Suppl.; No. 12, 237-240(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The technique used in radionuclide angiography for the diagnosis of arterial blood flow malfunctions following intravenous injections of ^{99m}Tc-pertechnetate is reported and the results obtained in a study of 121 patients are summarized in order to illustrate the effectiveness of the method in clinical practice. The indications for its use are tabulated. (JSR)

20082 CLINICAL VALUE OF THE ROUTINE USE OF QUANTITATIVE SCINTIGRAPHY COMPARED TO ANALOGUE SCINTIGRAPHY. Kiebooms, L.; Drieskens, L.; de Roo, M. J. K.

(Katholieke Univ., Leuven, Belg.). Nucl.-Med., Suppl.; No. 12, 241-245(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Methods for scintiscanning the liver and spleen using ^{113m}In-colloid and the value of computer analysis of scan data for the diagnosis of metastases and cirrhosis of the liver and extra-hepatic neoplasms are discussed. In doubtful cases a second scan using ^{67}Ga-citrate was also performed. Results of 155 scans showed an accuracy of 96% for the detection of liver metastases. (CH)

20083 SEQUENCE SCINTIGRAPHIC ORGAN FUNCTION DIAGNOSIS AND ITS MATHEMATICAL ANALYSIS USING THE LIVER AS AN EXAMPLE. Wolf, I.; Buttermann, G.; Oberdorfer, M.; Kretschko, J. (Technische Univ., Munich). Nucl.-Med., Suppl.; No. 12, 246-249(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

A method for the mathematical analysis of sequence scintigraphs of liver time/activity curves is described. The scintigraphs used in developing the method were obtained from phantom measurements using ^{131}I. (JSR)

20084 ^{131}I-TOLUIDINE BLUE FOR FUNCTION DIAGNOSIS AND SCINTIGRAPHY OF THE BILIARY SYSTEM. Eickenbusch, W.; Koka, R.; Stute, A. (Allgemeines Krankenhaus, Hagen, Ger.). Nucl.-Med., Suppl.; No. 12, 250-252(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The suitability of using ^{131}I-labelled toluidine blue for functional diagnosis and scintigraphy of the biliary system was investigated for four types of malfunctions and in a control group of healthy persons. The results showed that positive scintigraphs could be obtained in all cases except those in which there is a proximal occlusion. (JSR)

20085 STUDIES OF POTASSIUM DEPLETION IN HEPATIC CIRRHOSIS USING A WHOLE BODY COUNTER. Burrows, B. A.; Zimmerman, H. J.; Podolsky, S. (Veterans Administration Hospital, Boston). Nucl.-Med., Suppl.; No. 12, 253-254(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Endogenous ^{40}K measured in a whole-body counter with scanning geometry was found to be significantly lower in a group of 17 patients with hepatic cirrhosis than in 40 normal subjects. Mean body potassium was 2517 ± 150 mEq (35.7 ± 1.8 mEq/kg) in the cirrhotics and 3783 ± 300 mEq (49.4 ± 3.0 mEq/kg) in the normals. All cirrhotics had impaired carbohydrate tolerance. Seven of the 17 had increases of body potassium from 12.7 to 35.8% of the initial value during KCl administration. The observations indicate that potassium depletion in cirrhotics may occur with a normal serum potassium concentration and that it is associated with a diabetic glucose tolerance test and reduced output of both insulin and growth hormone. Potassium repletion may be accompanied by reversal of these hormonal abnormalities. (auth)

20086 RADIOIODINATED ROSE BENGAL CLEARANCE AS A LIVER FUNCTION TEST AFTER LIGATION OF THE HEPATIC ARTERIES IN DOGS. Zissiadis, A.; Grammaticos, P.; Vizantiadis, A.; Aletras, H.; Valtis, D. (Univ. of Thessaloniki, Greece). Nucl.-Med., Suppl.; No. 12, 255-258(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The consequences of the ligation of the hepatic artery and its branches were investigated in dogs, by use of scintiscanning to determine the clearance time of ^{131}I-Rose bengal. The method proved to be simple, quick, and accurate. (auth)

20087 PHARMACOLOGICAL MODIFICATION OF ^{75}Se-METHIONINE ENRICHMENT IN THE PANCREAS OF RATS BY LIVER-BINDING SUBSTANCES. Botsch, H. (Freie Univ., Berlin). Nucl.-Med., Suppl.; No. 12, 259-262(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Three substances were tested in rats for their effects on ^{75}Se-methionine uptake in the pancreas: an x-ray contrast medium (Biligram), bromosulfophthalein, and a bile acid. The results obtained show that all three substances cause a significantly higher activity in the pancreas. At very high doses of Bromthalein and the bile acid this effect disappeared. (JSR)

20088 RESULTS OF PANCREAS SUBSTRACTION SCINTIGRAPHY WITH USE OF SCANNERS AND TAPE OR IMAGE STORAGE. Buttermann, G.; Dressler, J.; Pabst, H. W. (Technische Univ., Munich). Nucl.-Med., Suppl.; No. 12, 263-266(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

A simplified double nuclide substraction scintigraphic method for the pancreas is described in which ^{75}Se-methionine and ^{198}Au colloid are injected 20 min before the scan. The results obtained in 83 scans are reported for normal persons and patients with different types of pancreas disease or tumor. A false positive result was obtained in only 12% of the cases. (JSR)

20089 COMPARISON OF ANGIOGRAPHIC AND SCINTIGRAPHIC RESEARCH RESULTS IN VARIOUS DISEASES OF THE PANCREAS. Deininger, H. K.; Barth, V.; Heuck, F. (Katharinenhospitals der Stadt, Stuttgart). Nucl.-Med., Suppl.; No. 12, 267-270(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Pancreas scintigraphy in combination with clinical findings is suitable for the detection of neoplasms and chronic inflammation changes and exclusion diagnostics. The pathological findings of pancreas scintigraphy must be supplemented with other methods. (tr-auth)

20090 RADIOIODINE UPTAKE IN METASTASIS OF A GASTRIC CARCINOMA. Lewitus, Z. (Tel Aviv Univ., Israel). Nucl.-Med., Suppl.; No. 12, 271-272(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Results are reported on ^{131}I scintiscans on three patients that showed iodophilic metastases of gastric carcinoma. (CH)

20091 MEASUREMENT OF STOMACH EMPTYING USING RADIOISOTOPES. Meves, M.; Beger, H. G.; Braun, D.; Kalk, J. F.; Apitzsch, D.; Kraas, E. (Freie Univ., Berlin). Nucl.-Med., Suppl.; No. 12, 273-276(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

By the use of scintiscanning following administration of ^{51}Cr-labelled standard meal, the stomach emptying time can be measured with sufficient accuracy and with a low radiation dose. The validity of the method was indicated by the measurement of the effect of intestinal hormones on stomach emptying and the study of the changes caused in stomach emptying by vagotomy and pyloroplasty. (tr-auth)

20092 $^{14}CO_2$ MEASUREMENT IN EXHALATION: APPLICATIONS AND EXPERIENCES IN CLINICAL DIAGNOSIS. Glanzmann, C.; Luetolf, U. H.; Horst, W. (Kantonsspital, Zurich). Nucl.-Med., Suppl., No. 12, 277-280(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The ^{14}C-labelled materials used in $^{14}CO_2$ exhalation measurements are briefly reviewed and typical exhalation results obtained in thyroid diseases and in patients with various gastrointestinal ailments. The types of studies made with exhalation measurements are tabulated. (JSR)

20093 MATHEMATICAL ANALYSIS OF A MULTICOMPACT MODEL TO PROTEIN CATABOLISM IN MAN. Ebersoldt, F.; Lisken, M.; Ritzl, F.; Schnippering, H. G.; Feinendegen, L. E. (Kernforschungsanlage, Juelich, Ger.). Nucl.-Med., Suppl.; No. 12, 281-284(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

A seven-compartment model of protein catabolism is presented and mathematically analyzed. The hypotheses on which the model is based are tabulated and the steps in the analysis are given. (JSR)

20094 MEASUREMENT OF PROTEIN CATABOLISM IN MAN USING MULTIPLE ISOTOPE TECHNIQUES AND MULITCOMPARTMENT MODEL. Ritzl, F.; Ebersoldt, F.; Schnippering H. G.; Feinendegen, L. E. (Kernforschungsanlage, Juelich, Ger.). Nucl.-Med., Suppl.; No. 12, 285-288(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

A new method for the study of protein catabolism consists in the double labelling of proteins and the measurement of the isotope

quotient as an expression of the non-destruction of the labelled protein. Variation of the quotients of the two different, but biologically coupled isotopes indicates the release of one of the isotopes and therefore of molecular decomposition. Supplementing such measurements with compartmental analysis expands and makes more precise the description of the metabolic processes involved. This method is applied to the function analysis of the reticuloendothelial system. The compartmental analysis used was illustrated first on the example of insulin catabolism. (JSR)

20095 CAMERA FUNCTION SCINTIGRAPHY AFTER HYPOTHERMIC IN SITU PERFUSION IN ANIMAL AND CLINICAL STUDIES. Heinze, H. G.; Eisenberger, F.; Pfeifer, K. J.; Rothe, R.; Chaussy, C.; Klein, U. (Univ., Munich). Nucl.-Med., Suppl.; No. 12, 289-294(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Kidney function after normothermally and hypothermally altered ischemia time was studied by camera function scintigraphy, ^{131}I-hippuran clearance, and ^{169}Yb-EDTA clearance. The laboratory chemical parameters for dogs and the clinical parameters were compared. The methods give a satisfactory function evaluation so that they can be used as indicators for the surgical procedure and for the post-operative care. (tr-auth)

20096 NUCLEAR MEDICAL METHOD FOR EVALUATION OF HYPOTHERMIC PERFUSION CONSERVED KIDNEYS. Albert, J. P.; Weissbach, L.; Huenermann, B.; Morakis, A. (Univ., Bonn). Nucl.-Med., Suppl.; No. 12, 295-297(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Two methods for the evaluation of the transplantability of preserved canine kidneys were studied. The first was ^{131}I-hippuran clearance and the results showed that it was not a suitable evaluation method. The second was the determination of ^{113m}In-EDTA transit time and this method proved to be a valid indication of undamaged organs. (JSR)

20097 INTRARENAL HIPPURAN TRANSPORT AND KIDNEY CORTEX BLOOD FLOW IN TRANSPLANTED KIDNEYS. Pfeifer, K. J.; Schmidt, K. R.; Kantlehner, R.; Seyffart, G.; Ingrisch, H.; Heinze, H. G. (Univ., Munich). Nucl.-Med., Suppl.; No. 12, 298-302(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

A study was made to compare the variations in hippuran kinetics in transplanted kidneys with the blood flow and blood flow distribution. The blood flow and blood flow distribution was measured with scintillation counter after i.v. injection of ^{133}Xe. The hippuran kinetics were measured by function scintigraphy using ^{131}I labelling of the hippuran. In 15 patients with no signs of rejection of the transplanted kidney, both hippuran kinetics and blood flow were normal. In cases with slight chronic rejection there is a significantly lengthened intrarenal hippuran transport with a corresponding decrease of the blood flow in the cortex. The blood flow distribution was only slightly altered. In severe chronic rejection the intrarenal hippuran transport was even more restricted and there was a sharp decrease of the blood flow in the first and second compartments. There was also a displacement of the blood flow distribution toward the cortex. (JSR)

20098 DETERMINATION OF TRANSPORT TIMES OF ^{131}I-HIPPURAN IN THE KIDNEY. Trost, C.; Heinrich, W. (Univ., Homburg, Ger.). Nucl.-Med., Suppl.; No. 12, 303-306(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The evaluation of the outflow phase of nephrograms is often quite difficult, primarily because the nephrogram is a summation curve and its summands are not known. An attempt was made to calculate these individual summands in order to obtain a true outflow curve and analyze it. The results were applied to the analysis of transport times of ^{131}I-hippuran in the kidney with good results. The advantages of the method used are tabulated. (JSR)

20099 ANIMAL EXPERIMENTAL RESULTS ON CATHETERLESS LATERALLY SEPARATED ^{131}I-HIPPURAN CLEARANCE WITH EPA CORRECTION USING A CAMERA COMPUTER SYSTEM. Huemermann, B.; Weissbach, L.; Wesener, K.; Winkler, C. (Univ., Bonn). Nucl.-Med., Suppl.; No. 12, 307-311(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The validity of the method previously reported for the catheterless laterally separated determination of ^{131}I-hippuran clearance, in which correction was made for the extraparenchymal activity (EPA) in the extrarenal body tissue and the blood, was tested in animal experiments on mongrels. The results obtained were compared with those obtained in the steady-state clearance measurements by ureter catheter and also with results obtained using the Oberhausen method and the Pixberg method. The EPA-corrected results and the steady-state measurements were comparable. The results obtained with the other two methods were not comparable, but the Pixberg method results were comparable if EPA corrections were made. (JSR)

20100 NUCLEAR MEDICAL POSSIBILITIES FOR THE QUANTITATIVE LATERAL COMPARISON OF KIDNEY FUNCTION. Peters, P. E.; Pixberg, H. U.; Pfannenstiel, P.; Henne, W.; Schmarsow, R. (Deutsche Klinik fuer Diagonstik, Wiesbaden, Ger.). Nucl.-Med., Suppl.; No. 12, 312-317(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Comparative measurements of the catheterless laterally-separated clearance and the direct ^{133}Xe kidney blood flow measurements were made in 19 patients. In 13 cases there was good agreement for the two methods. The causes for the divergences in the other cases were discussed. (tr-auth)

20101 CLINICAL DETERMINATION OF GLOMERULAR FILTRATION RATE WITH FIVE RADIOACTIVE COMPOUNDS. Marketos, S.; Kostamis, P.; Constantinides, C.; Malamos, B. (Athens Univ. Medical School). Nucl.-Med., Suppl.; No. 12, 318-319(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The clearance rates of ^{57}Co-B_{12}, ^{125}I-IOT, ^{51}Cr-EDTA, ^{131}I-DTZ, and ^{99m}Tc-DTPA were compared with chemical C_{Bl} in 25 patients with either normal or reduced renal function. Statistical analysis showed that ^{125}I-IOT, ^{51}Cr-EDTA, and ^{131}I-DTZ are the compounds of choice. (auth)

20102 RENAL BLOOD FLOW IN NEPHROPTOSIS. Locher, J. T.; Rist, M.; Staedtler, K.; Rutishauser, G.; Reidiger, A.; Schoenenberger, G. A. (Univ., Basel). Nucl.-Med., Suppl.; No. 12, 320-324(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

In experiments on anesthetized dogs whose vital functions were maintained and monitored instrumentally, one kidney was subjected to a blockage of the A. renalis, to a blockage of the V. renalis, or ureteral occlusion and the other kidney was used as control. Lactate dehydrogenase (LDH) measurements were made of both the total LDH and the organ-specific isoenzymes of urine samples taken separately. The flow rates were measured by the ^{133}Xe method. The total urine LDH in arterial blockage increased significantly during the blockage in contrast to only an insignificant increase in the unblocked kidney. The medulla-specific isoenzyme increased but the cortex-specific isoenzyme decreased. After release of the blockage, the LDH value rapidly fell to its initial values. In venous contrictions there were variations in the Xe wash-out curves and increase of LDH. With ureteral obstruction there was first an increase of the pressure in the renal pelvis and then to measurable changes in the arterial flow. The LDH value remained constant. The physiological, pathophysiological, and therapeutic consequences of these results are discussed. (JSR)

20103 ^{40}K WHOLE-BODY MEASUREMENTS IN NEPHROLITH DISEASE AFTER POTASSIUM THERAPY. Pfau, A.; Kallistratos, G. (Max-Planck-Institutes fuer Tierzucht und Tierernaebrung, Mariensee, Ger.). Nucl.-Med., Suppl.; No. 12, 325-328(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The total body K was determined by ^{40}K whole-body measurements in persons with kidney stones and in healthy persons selected to correspond to the patients in sex, weight, and age. The results were compared to results obtained from an empirical formula for the determination of normal body K. A Gaussian curve resulted, but the maximum for the persons with kidney stones was displaced to indicate a K deficit in the body. The total body K was monitored in patients receiving K therapy. The therapy resulted in no improvement in the K deficit but to an increase of K precipitates in the urine. (JSR)

20104 BLOOD FLOW MEASUREMENTS IN MALE TESTICLES WITH ^{133}Xe: METHODS AND FIRST CLINICAL RESULTS. Fill,

H.; Marberger, M.; Riccabona, G. (Urologische Univ., Innsbruck). Nucl.-Med., Suppl.; No. 12, 329-332(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The Wax and Peterson method for the measurement of ^{133}Xe clearance in testicles was applied to unanesthetized males. Twenty-three patients with prostate carcinoma received percutaneous injections of ^{133}Xe in the testicle parenchyma. The pattern of the radioactivity was followed with a gamma camera. The results are tabulated and show that this is a useful and harmless method for obtaining quantitative data on testicle blood flow. (JSR)

20105 FERROKINETIC INVESTIGATIONS IN MEDICALLY-INDUCED SUPPRESSION OF ERYTHROPOIESIS. Werner, E.; Kaltwasser, J. P.; Becker, H. (Univ., Frankfurt am Main). Nucl.-Med., Suppl.; No. 12, 333-335(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The hematotoxic side effects of thiamphenicol (TAP) on the ferrokinetics were measured in three groups of patients using ^{59}Fe as a tracer. The plasma iron clearance was measured in the first group of patients on the fourth day of therapy, in the second group on the penultimate day, and in the third group two weeks after the end of therapy. In the first group, no significant deviation of the ferrokinetic data from the normal was observed. In the second group there was considerable deviation from normal; the time for plasma clearance was twice as long as normal. This effect is reversible as was shown by the third group, who had all measured and calculated parameters in the normal range. (JSR)

20106 WHOLE-BODY MEASUREMENTS OF IRON KINETICS IN THE WHOLE-BODY COUNTER. Hoeck, A.; Schnippering, H. G.; Ritzl, F.; Persigehl, M.; Feinendegen, L. E. (Kernforschungsanlage, Juelich, Ger.). Nucl.-Med., Suppl.; No. 12, 336-339(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

With a scanning arrangement in the whole-body counter and using a slit collimator it was possible to obtain distributions and displacements of the iron in the whole organism. The examples given of the iron values in eight healthy persons and five patients show that a comparison over a long observation time among the iron values in the upper abdomen region (liver-spleen region), in the thorax region (at the top of the sternum), and in the pelvic region (at the top of the Os sacrum) yields diagnostically valuable indications. The utility of this method was tested extensively and also appears useful for the determination of the kinetics of a number of radiopharmaceuticals introduced in the lowest radioquantities. (tr-auth)

20107 NEW NUCLEAR MEDICAL METHOD FOR THE DETERMINATION OF THE TOTAL IRON-BINDING CAPACITY OF SERUM. Hellmann, E. (Westfaelische Wilhelms-Univ., Munster, Ger.). Nucl.-Med., Suppl.; No. 12, 340-343(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

A method is given for the determination of the total iron-binding capacity of serum. It is based on the release of bound iron with citric acid, deposition on an ion exchanger, sedimentation by centrifugation, isotopic dilution with ^{59}Fe, and counting. The method requires only 1 ml of serum and is fast with good reproducibility. It is suitable for clinical use. The free iron can be determined by the same method, but with the elimination of the citric acid step. (JSR)

20108 FERROKINETICS IN CHRONIC DIALYSIS PATIENTS. Jontofsohn, R.; Junkers, K.; Meuret, G.; Heinze, V.; Tourkantonis, A. (Medizinische Univ. Poliklinik, Freiburg i. B.). Nucl.-Med., Suppl.; No. 12, 344-347(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The results of measurements of the ferrokinetics in six dialysis patients, two of whom had undergone bilateral nephrectomies, were reported in tabular form. The results showed that the non-nephrectomized patients show an almost complete iron utilization. On the other hand nephrectomized patients show a significant reduction in iron utilization. (JSR)

20109 COMPUTER FINDINGS USING THE SCHILLING TEST AS AN EXAMPLE. Vogel, H. (Univ., Hamburg). Nucl.-Med., Suppl.; No. 12, 348-351(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The flow diagram was given for computer diagnosis of the Schilling test using the percentage ^{58}Co eliminated in the urine after oral ingestion of labelled vitamin B_{12} as an indication of the enteral resorption. The example is given in order to show the value of computer diagnosis in clinical work. (JSR)

20110 FOLIC ACID SERUM LEVEL IN GREEK HIGH-SCHOOL STUDENTS. Malamos, B.; Fessas, P.; Gyftaki, E.; Kesse-Elias, M.; Roussos, C.; Mantzos, J. (Alexandra University Hospital, Athens). Nucl.-Med., Suppl.; No. 12, 352-354(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Serum folic acid levels were measured in 600 Greek high-school students. A radioactive (^{3}H) competitive protein binding technique developed by one of the authors (JM) was used for the analysis. The results show that although the mean value from all the areas is in the normal range, it differs significantly from that of the normal adults tested. The student's values were lower than the adults. (ERB)

20111 ESTIMATION OF SERUM FOLIC ACID AND VITAMIN B_{12} WITH COMPETITIVE PROTEIN BINDING METHODS IN PREGNANCY. Kesse-Elias, M.; Vrettos, A.; Gyftaki, E.; Alevizou-Terzaki, V.; Roussos, C.; Mantzos, J. (Univ. of Athens Medical School, Athens). Nucl.-Med., Suppl.; No. 12, 355-358 (1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Folic acid and vitamin B_{12} blood serum levels were estimated in 160 pregnant women in Greece in an effort to determine the occurrence of folic acid and vitamin B_{12} deficiencies. Folic acid and vitamin B_{12} were determined by competitive protein binding techniques. It was determined that both folic acid and vitamin B_{12} serum levels diminish throughout normal pregnancy in Greece. (ERB)

20112 LABELING OF THROMBOCYTES USING SMALL BLOOD VOLUMES. Berberich, R.; Gloebel, B. (Univ., Homburg, Ger.). Nucl.-Med., Suppl.; No. 12, 359-362(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

A method for the labelling of thrombocytes with ^{51}Cr using only 50 ml of blood is described. It is based on the centrifugation of the blood, separation of the platelet-rich plasma, recentrifugation after addition of ACD, and introduction of the thrombocyte-rich fraction to a ^{51}Cr-sodium chromate solution. The labelling obtained with this method was comparable to the normal labelling method and the erythrocyte contamination was much less. It can be successfully used in patients with quite low thrombocyte count. (JSR)

20113 BLOOD VOLUME DETERMINATION WITH A ^{113m}In-HUMAN TRANSFERRIN COMPLEX. Dressler, J.; Buttermann, G.; Hoer, G. (Technische Univ., Munich). Nucl.-Med., Suppl.; No. 12, 363-366(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The possibility of using ^{113m}In-human transferrin complex for the measurement of blood volume was investigated on 50 patients. The results showed that the biological half-life is about 14 hours. A differing pattern for the time activity curve was observed in the blood pool and liver. No accumulation occurred in the bladder during the first hours after injection. It was concluded that the use of this complex was a valuable radiopharmaceutical for blood volume determinations in spite of some disadvantages. (JSR)

20114 RESULTS OF BONE MARROW SCINTIGRAPHY WITH ^{99m}Tc-SULFUR COLLOID AND ^{111}In-CHLORIDE. Gamm, H.; Fischer, J.; Wolf, R. (Univ., Mainz). Nucl.-Med., Suppl.; No. 12, 367-369(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Clinical results obtained with the use of ^{99m}Tc-sulfur colloid and $^{111}InCl_3$ in bone marrow scintigraphy are reported. The $^{111}InCl_3$ can be used in the detection of a lack of erythropoiesis, the ^{99m}Tc-sulfur colloid can not be used for this purpose. Both the compounds can be used for the detection of accumulation defects in Hodgkin's disease and after radiotherapy. (JSR)

20115 NEW DATA ON THE PROBLEM OF RADIOACTIVE LABELLING OF LYMPH DISCHARGE REGION OF THE PELVIS.

Gitsch, E.; Janisch, H.; Leodolter, S. (Univ. Frauenklinik, Vienna). Nucl.-Med., Suppl.; No. 12, 370-373(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

In the surgical treatment of cervical cancer the property of the lymphoreticular tissue to accumulate radiogold colloid was used to ensure as complete as possible removal of the regional lymph tissue. The clinical results obtained with this technique and the procedure used are briefly described. (JSR)

20116 CLINICAL DATA OF WHOLE-BODY SKELETON SCINTIGRAPHY WITH VARIOUS RADIOACTIVE MATERIALS (EVALUATION OF 417 CASES). Feine, U.; Anger, K. (Univ., Tuebingen, Ger.). Nucl.-Med., Suppl.; No. 12, 374-376(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The clinical results obtained in the use of ^{85}Sr, ^{87m}Sr, and ^{99m}Tc in whole-body skeleton scintigraphy for diagnosis of metastases, primary bone tumors, systemic diseases of the skeleton, inflammatory diseases of the bone and osteonecroses are compared with results obtained by x radiography. The evaluation of the clinical results proved the value of the method. (JSR)

20117 RESULTS OF SCANNER AND CAMERA SEQUENCE SCINTIGRAPHY IN COMPARISON WITH X-RAY DIAGNOSIS (UNTREATED PICTURES AND ANGIOGRAPHY) AND THERMOGRAPHY IN BONE DISEASES. Hoer, G.; Keyl, W.; Langhammer, H.; Heidenreich, P.; Herzog, M.; Buttermann, G.; Pabst, H. W. (Univ., Munich). Nucl.-Med., Suppl.; No. 12, 377-382(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The results obtained from scintigraphy, x-rays, angiograms, and thermograms in the diagnosis of 165 confirmed bone diseases were compared. Strontium-85, ^{87m}Sr, and ^{99m}Tc-polyphosphate were used for the scanning scintigraphy. The tabulated results show that scintigraphy gave positive results more often than the other methods. Sequence scinitgraphy with ^{99m}Tc-polyphosphate was used to differentiate between hyperenic and anemic bone tumors. (JSR)

20118 VALIDITY OF SCINTIGRAPHY, THERMOGRAPHY, AND CLINICAL DIAGNOSIS FOR ACTIVITY EVALUATION OF OSTEOMYELITIC PROCESSES. Imhof, H.; Czembirek, H.; Pichler, H.; Pokieser, H.; Umek, H. (Medizinische Univ., Vienna). Nucl.-Med., Suppl.; No. 12, 383-388(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Scintigraphy with ^{87m}Sr, thermography, and clinical evaluation were compared with respect to the capacity of each technique to give a valid diagnosis of recurrence of octeomyelitis in 50 chronically ill patients. The results showed that scintigraphy gave the best results and that the possibility of error was greatest in the use of thermography. (JSR)

20119 INVESTIGATIONS WITH A ^{123}I-PROFILE SCANNER IN PATIENTS WITH STRATIFIED OSTEOPOROSIS. Breuel, H. P.; Hesch, R. D.; Emrich, D. (Univ., Goettingen, Ger.). Nucl.-Med., Suppl.; No. 12, 389-390(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

A previously proposed method for the early diagnosis of osteoporosis and for following the therapeutic results was the determination of the linear absorption coefficient of one finger. The validity of the method was tested on 52 patients with radiologically confirmed osteoporosis and a pathological absorption coefficient was obtained in only 21 cases. It is concluded that the method does not give sufficiently safe results on the presence of osteoporosis or other bone illnesses. (JSR)

20120 TRACER STUDIES (^{85}Sr) ON THE EFFECT OF THE IMMUNE REACTION TO THE RESORPTION OF THE MINERAL CONSTITUENTS OF EXPERIMENTAL BONE GRAFTS. Kollmer, W. E.; Slat, B.; Buell, U.; Balser, B. (Univ., Munich). Nucl.-Med., Suppl.; No. 12, 391-394(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

^{85}Sr-labelled whole tibias from 6-day old C3H/Neu and 101/neu mice were transplanted to growing C3H/neu mice and whole-body measurements made over a period of 72 days to determine the elimination and resorption of ^{85}Sr as a measure of the resorption of the mineralized constituents. The curves of the ^{85}Sr content show that the syngenic transplants are decomposed more rapidly than the allogenic transplants. Supplementary studies made in the transplanting of spongiosa of adult donors showed a sharper decrease of the radioactivity which was more pronounced in the syngenic transplants that in the allogenic. (JSR)

20121 RECENT ADVANCES IN ^{99m}TECHNETIUM RADIOPHARMACEUTICALS. Richards, P.; Smith, T. D. (Brookhaven National Lab., Upton NY.). Nucl.-Med., Suppl.; No. 12, 396-399(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Technetium-99m-labeled pertechnetate and human serum albumin have been used in recent years in cardiovascular diagnostics. However, each has its disadvantages. The author suggest that ^{99m}Tc-labeled erythrocytes would be ideal for such applications if the labeling procedure could be made relatively simple and rapid. The authors describe a labeling procedure that is relatively rapid and labels up to 90% of the erythrocytes present in whole blood samples. (ERB)

20122 DEVELOPMENT OF NEW RADIOPHARMACEUTICALS FOR ORGAN SCINTIGRAPHY. Tubis, M.; Krishnamurthy, G. T.; Blahd, W. H. (Wadsworth Hospital Center, Los Angeles). Nucl.-Med., Suppl.; No. 12, 400-402(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The development of four new radiopharmaceuticals for organ scintigraphy is described. The renotropic agent acetazolamide was used in the preparation of ^{99m}Tc-Penicillamine-Acetazolamide Complex for use in kidney scanning. The new gall bladder scanning agent, ^{99m}Tc-Penicillamine, is safe. Unlike oral cholecystographic agents, it is not toxic to the kidneys. The search for a biodegradable perfusion lung scanning agent that leaves no metallic residues resulted in the development of ^{113m}Indium Sulfide Macroaggregate. Results with the new lung scanning agent were superior to ^{131}I-MAA and as good as ^{99m}Tc-MAA. The need for an agent to differentiate amebic hepatic abscesses from other space-occupying lesions by gamma-ray scintigraphy led to the development of ^{131}I-labeled Bromometronidazole and ^{99m}Tc-labeled Flagyl. Animal experiments demonstrated the lack of toxicity and high liver concentrations of both radiopharmaceuticals. Plans to replace the ^{131}I with ^{123}I will increase the dose and reduce the radiation to the patient. (ERB)

20123 NEW ACCELERATOR PRODUCED RADIOPHARMACEUTICALS. Richards, P.; Lebowitz, E. (Brookhaven National Lab., Upton, NY). Nucl.-Med., Suppl.; No. 12, 403-406(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Several new accelerator produced radioisotopes have potential applications in nuclear medicine. The radioisotopes and their potential uses include: ^{123}I (thyroid function and imaging); ^{127}Xe (lung perfusion and ventilation-blood flow measurements); ^{52}Fe (bone marrow imaging); ^{201}Tl(cardiac imaging-kidney studies); ^{97}Ru(lymphangiography); and ^{82}Rb(myocardial blood flow and function). The radioisotopes are being developed at the Brookhaven Linac Isotope Producer facility. (ERB)

20124 RADIOLABELED COMPOUNDS IN THE DIAGNOSIS OF ADRENAL DISEASES. Beierwaltes, W. H. (Univ. of Michigan, Ann Arbor). Nucl.-Med., Suppl.; No. 12, 407-412(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Two patients suspected of having an adenoma of the adrenal gland were given intravenous doses of 2 μCi of ^{131}I-19-iodocholesterol for adrenal imaging. Radioactive hot modules were observed in the adrenal cortex with suppression of uptake in normal adrenal tissue but without elevated plasma cortisol levels. The suppressed values followed dexamethasone administration. Uptake was restored to normal following ACTH administration. Data on the patients is presented in tabular form. The authors feel that it is premature to advocate the use of this technique for routine screening of patients for adrenal abnormalities. (ERB)

20125 BIOKINETICS OF ^{99m}Tc-PYROPHOSPHATE. Keyl, W.; Kriegel, H.; Hoer, G.; Heidenreich, P. (Technische Univ., Munich). Nucl.-Med., Suppl.; No. 12, 413-417(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The biokinetics of ^{99m}Tc-pyrophosphate were studied in Wistar rats. The results showed that the pyrophosphate was deposited in

a higher percentage in the skeleton than $^{99m}TcO_4$. The blood and muscle clearance of the pyrophosphate was initially more rapid but that of the oxide was more complete. With both compounds, the kidneys showed a biphasic retention mode. The deposition of the pyrophosphate in the skeleton is age-dependent. There was no sex dependence for its retention. (tr-auth)

20126 RENAL ACCUMULATION OF ^{99m}Tc-TIN-PYROPHOSPHATE DURING BONE SCINTIGRAPHY. Konstantopoulos, A.; Vevelojiannis, D.; Triantaphyllou, D.; Daskalakis, E. Nucl.-Med., Suppl.; No. 12, 418-420(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The TPyP renal accumulation observed while scanning the bones of the kidney region was examined in 69 patients. Pointers of clinical history and laboratory studies indicative of renal function and morphology were available from the hospital records and were correlated to the degree of equality of Tc-T-PP renal concentration as it was visualised on the scans. We realise that the number of our cases is not so comprehensive to establish conclusions of high significance; the criterion of scanning classifications is also not so objective. However, the following remarks may be derived: one silent kidney resulted in all the cases in unequal concentration scan; the degree of unequality was strong in most of the cases; a large majority of patients (82%) with normal kidneys presented scans with equal concentration and when the scans were unequal the degree of unequality was small; scans with equal concentration in 86% of the cases were correspond to normal ones; and scans with unequal concentration in 68% of the cases were corresponded to unilateral abnormalities. In our study there are two more points which we would like to stress: normal kidneys, as far as IVP and kidney profile is concerned, gave in 18% unequal scans; and 82% of normals gave equal scans. In 23 (62%) cases the concentration was marked, in 7 (18%) cases it was slight, and in 8 (21%) cases there was no concentration at all. The discrepancy in the concentration might be due to the difference in time (1 or 2 hours) between injection and scanning. (auth)

20127 ANIMAL EXPERIMENTAL AND CLINICAL STUDIES ON BONE ENRICHMENT IN ^{99m}Tc-PYROPHOSPHATE AND ^{99m}Tc-DIPHOSPHONATE. Buell, U.; Balser, D.; Frey, K. W.; Hueber, M. (Univ., Munich). Nucl.-Med., Suppl.; No. 12, 421-425(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Twenty-eight rabbits were injected i. v. with ^{85}Sr, ^{99m}Tc-Pyrophosphate (n = 20), and ^{99m}Tc-Diphosphonate (n = 8). The animals were sacrificed one to three hours p. i. and contents of radioactivity were measured in blood, urine, kidneys, muscles, liver, thyroid gland, and in different osseous regions. Relative to ^{85}Sr, ^{99m}Tc-Phosphate-compounds deposit even more in cancellous bone. In comparison with ^{85}Sr the greatest ratio of radioactivity bone to muscle was found in ^{99m}Tc-Pyrophosphate. ^{99m}Tc-Diphosphonate showed the fastest muscle-clearance but osseous accumulation was less than in ^{85}Sr three hours p. i. Low radioactivity in the thyroid gland suggests a good in vivo stability of ^{99m}Tc-labellings. In patients, both ^{99m}Tc-Phosphate compounds have been used in bonescanning and in measuring radioactive contents in bone-soft tissue-pool by a blood-subtraction method with ^{113m}In. Compounds showed a faster muscle-turnover and were found to accumulate more in cancellous than in compact bone if compared with ^{87m}Sr. ^{99m}Tc-Pyrophosphate was proved to be the best boneseeking agent having been tested. (auth)

20128 EARLY DETECTION OF SKELETAL METASTASES FROM BREAST CANCER USING ^{99m}Tc-POLYPHOSPHATES. Citrin, D. L.; Bessent, R. G.; Tuohy, J. B.; Calder, J. F.; Blumgart, L. H.; Greig, W. R. (Royal Infirmary, Glasgow). Nucl.-Med., Suppl.; No. 12, 426-428(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Eighty female patients with breast cancer were given either ^{99m}Tc-labeled polyphosphate, pyrophospate, or diphosphonate to determine their effectiveness in the early detection of skeletal metastases. In 93% of the cases with known metastatic disease (x-ray positive), the scans were positive. Overall, the scans were more effective than radiography in estimating the incidence of metastases. It was concluded that the ^{99m}Tc-labeled phospate scanning agents were safe and effective in the detection of early skeletal metastases. (ERB)

20129 BONE SCINTIGRAPHY WITH ^{99m}Tc-Sn PYRO- AND POLYPHOSPHATE, A CLINICAL STUDY ON 288 PATIENTS. Luetolf, U. M.; Piroth, H. D.; Magdeburg, W.; Renk, I. W.; Horst, W. (Kantonsspital, Zurich). Nucl.-Med., Suppl.; No. 12, 429-432 (1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The advantages and disadvantages of ^{99m}Tc-Sn pyrophosphate (TPyP) and ^{99m}Tc-Sn polyphosphate (TPoP) were compared with each other and with previous Sr studies in clinical research on 288 patients. The results show that the diagnostic certainty with TPyP and TPoP in search for bone metastases is superior to x-ray picture and also to Sr scintigraphy in the hardness of the data. No variation in the dynamics and representation capacity was found between the two but the TPoP was more reliable in the batches provided. The advantage in the use of ^{99m}Tc is the possibility of skeleton images within 4 to 6 hours and the availability of a camera for very accurate placement of the metastases. (JSR)

20130 FIXATION OF ^{99m}Tc-Sn PYROPHOSPHATE IN INFLAMMATORY PROCESSES OF THE MASTOID. Koutoulidis, C.; Stamatis, C.; de Tovar, G.; Panopoulos, M. (Hopital Militaire General, Athens). Nucl.-Med., Suppl.; No. 12, 433-437 (1974). (In French).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The inflammatory activity of the mastoid process was measured in 32 patients afflicted with unilateral oto-mastoiditis using ^{99m}Tc-Sn pyrophosphate (TPyP). Twelve persons free of all inflammation were used as controls. The measurements were made by external counting with a gamma scintillation detector. All the patients were given a comparative scintigram to determine the extent of the inflammation. The results of the measurements of healthy and ill persons were compared. The difference between the two were quite significant statistically. The fixation was more intense in acute or paroxysmic cases than in chronic cases. The results were compared with radiological and histological data. (tr-auth)

20131 CLINICAL AND EXPERIMENTAL STUDIES ON ^{99m}Tc-PYROPHOSPHATE. Doppelfield, E.; Kutzim, H. (Univ., Cologne). Nucl.-Med., Suppl.; No. 12, 438-442(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The in-vivo behavior of ^{99m}Tc-pyrophosphate (TPyP) was studied experimentally in white male mice and the distribution of its components was determined by following the deposition of ^{32}P-polyphosphate and ^{99m}Tc-pertechnetate. The autoradiographic studies showed that the high bone affinity of this bone-seeker can be traced to the pyrophosphate component. The TPyP is stable in the organism and eliminated through the kidneys. In 41 whole-body scintigraphs its stability in men was confirmed. The results obtained from skeleton scintigraphy in these patients showed that it is highly suitable for this purpose. The only extraosseous enrichment of TPyP was found in the kidneys. (JSR)

20132 RADIOPHOSPHATE IN BONE TUMOR DIAGNOSIS. Comparison of Polyphosphates, Pyrophosphates, and Sr Isotopes. Wilvonseder, R.; Hoefer, R. (Univ. Klinik, Vienna). Nucl.-Med., Suppl.; No. 12, 443-448(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

On the basis of 117 scintigraphs, some local and some whole-body, using various commercially obtainable Tc-labeled phosphate compounds, the superiority of these radiopharmaceuticals for bone tumor diagnosis over the conventially used ^{87m}Sr was shown. A comparison of the percentage organ distribution of the two isotopes shows that the blood level for the phosphate is higher than for Sr, but the muscle activity for pyrophosphate is smaller by a factor of two than for polyphosphate. The elimination of both phosphates by the kidneys is an order higher than for Sr. Picture quality, radiation burden, storability, and costs of the individual nuclides are comparable with each other. But the pyrophosphate is preferable because of its more favorable organ distribution. (JSR)

20133 COMPARATIVE ANIMAL EXPERIMENTAL AND CLINICAL STUDIES ON THE OSTEOTROPIC BEHAVIOR OF ^{18}F AND ^{99m}Tc-LABELLED PHOSPHATES. Georgi, P.; Sinn, H.; Erbs, G.; Kubesch, R.; Thuesing, F. J. (Deutsche Krebsforschungszentrum, Heidelberg). Nucl.-Med., Suppl.; No. 12, 449-452(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Out of a total of 295 patients scintigraphed, 176 were studied with ^{18}F, half of the remaining 119 were studied with ^{99m}Tc-polyphosphate (TPoP), and the other half with ^{99m}Tc-pyrophosphate (TPyP). The quality of the scintigrams obtained with the phosphate compounds varied greatly from case to case. In contrast to ^{18}F there was a significant kidney deposition and in 50% of the scintigrams there was liver deposition. In animal experiments on rats, the body elimination of the ^{99m}Tc compounds was much more rapid than that for compounds labeled with ^{18}F, ^{133m}Ba, or ^{85}Sr, and within 2 hrs post injection almost 30% of the ^{99m}Tc activity was eliminated. The ratio of skeleton to soft tissue active was 9:1 for ^{18}F and only 2.2:1 for the phosphates. (JSR)

20134 SCINTIGRAPHY WITH ^{99m}Tc-PYROPHOSPHATE, ^{99m}Tc-POLYPHOSPHATE, AND ^{87m}Sr, AND PROFILE MEASUREMENTS WITH ^{85}Sr IN COMPARISON WITH X-RAY TOMOGRAPHY IN DISEASES OF THE FACIAL PROTION OF THE SKULL AND SKULL BASE. Frey, K. W.; Buell, U.; Hueber, M.; Hennemann, H.; Muezel, M. (Univ., Munich). Nucl.-Med., Suppl.; No. 12, 453-458(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

In the detection of the recurrence of benign tumors, nuclear medical techniques were shown to be superior to x-ray tomography because of the scarring caused by previous surgery. Of the 46 benign tumors studied both by tomography and nuclear medicine, very good agreement was obtained 27 times. Tomograms gave a clearer diagnosis 9 times and 10 times the scintigraphy or profile scan gave more data. (JSR)

20135 RESULTS WITH ^{57}Co-LABELLED BLEOMYCIN FOR TUMOR SCINTIGRAPHY. Haubold, U.; Schmilowski, M.; Janssen, B. (Freie Univ., Berlin). Nucl.-Med., Suppl.; No. 12, 459-465 (1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The new tumor-affinity material, ^{57}Co-bleomycin, was tested in clinical studies on 80 patients and justified the optimistic conclusions reported for a very limited number of patients. The principal indication for tumor scintigraphy with this substance is liver metastasis diagnosis, in which a considerable increase in detection sensitivity is found, especially if the subtraction technique is used. For brain scintigraphy it is a valuable supplement to the conventional pertechnetate scintigrams. This is especially ture for tumors in the vicinity of the skull base and for the detection of the recurrence of tumors in patients who had received surgery and/or irradiation. This substance should become significant in diagnosis of abdominal tumors. Its use in diagnosis of thoracic processes does not appear suitable since irregular banded activity distributions were found in thorax scintigrams. (tr-auth)

20136 TUMOR VISUALIZATION BY SCINTIGRAPHY USING RADIOACTIVE BLEOMYCIN. Papavasiliou, C.; Ramos, D.; Sfontouris, J.; Kostamis, P.; Constantinides, C.; Binopoulos, D. (Alexandra Hospital, Athens). Nucl.-Med., Suppl.; No. 12, 466-468(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Experiences in the use of ^{57}Co-bleomycin for scintigraphic tumor visualization are reported. Of 28 patients evaluated, with tumors in the head and neck, thorax, abdomen, or pelvic regions, 18 of the timors were visualized using this agent. In general, the visualization obtained by bleomycin was faint in comparison to gallium scans. (ERB)

20137 TUMOR SCINTIGRAPHY WITH ^{57}Co-BLEOMYCIN. Jung, H.; Gamm, H.; Fischer, J.; Wolf, R.; Huelse, R.; Grimm, W. (Johannes Gutenberg Univ., Mainz). Nucl.-Med., Suppl.; No. 12, 469-471(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

^{57}Co-bleomycin was used for tumor scintigraphy in 38 patients. The results indicate that it is suitable in pavement epithelium carcinomas of the head and neck region both for detection of primary tumors and for the detection of recurrence and metastases. The applicability of the method to the detection of other tumors, especially in the thorax and abdominal regions, appears low. (JSR)

20138 ^{111}In-BLEOMYCIN COMPARED WITH ^{67}Ga AND ^{75}Se IN TUMOUR SCINTIGRAPHY. Rasmussen, J. W.; Frederiksen, P. B.; Kalnaes, O. (Odense Sygebus, Denmark). Nucl.-Med., Suppl.; No. 12, 472-475(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Thirty patients with malignant tumors were investigated by ^{111}In-bleomycin scintigraphy. Tumor imaging with this radiopharmaceutical agent was compared with that of ^{67}Ga-citrate and ^{75}Se-selenite. Good visualization with ^{111}In-bleomycin was obtained for various types of tumors, including those in the abdomen. With ^{67}Ga-citrate and ^{75}Se-selenite, the activity in the intestinal tract is normally high, and this often presents problems in interpreting the scintigrams when searching for abdominal tumors. Indium-111-bleomycin is not concentrated in the intestinal tract, and would thus appear to be of special advantage in tumor imaging of the abdominal area. (auth)

20139 CLINICAL-EXPERIMENTAL STUDIES ON THE QUANTITATIVE ^{67}Ga ENRICHMENT IN MALIGNANT AND NON-MALIGNANT TISSUES. Kempken, K.; Benoit, H.; Langhammer, H.; Heidenreich, P.; Hoer, G.; Harlacher, A. (Technische Univ., Munich). Nucl.-Med., Suppl.; No. 12, 476-480(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

On the basis of studies on 37 patients, of whom 31 had tumors in the thorax region, it was concluded that lung carcinomas show a seven times stronger ^{67}Ga enrichment than normal lung tissue. There is no significant difference between differentiated and undifferentiated lung carcinomas with respect to the radioactivity concentrations. With increase of the necrotic or fibrotic tissues, the ^{67}Ga deposition in the tumors decreases. Its deposition is therefore dependent on the existence of vital tumor tissue. Pure tumor necroses have no Ga deposition. Inflammatorily changes, non-neoplastic tissue has an increased Ga accumulation with respect to normal tissue, but it is much less than in malignant tissue. (JSR)

20140 SCINTIGRAPHIC TUMOR DIAGNOSIS AND QUANTITATIVE DYNAMIC STUDIES WITH ^{67}Ga IN PATIENTS WITH SYSTEMIC DISEASE. d'Addabbo, A.; Mele, M.; Fanfani, M.; Damoto, D.; Liso, V.; Timurian, A. (Univ., Bari, Italy). Nucl.-Med., Suppl.; No. 12, 481-488(1974). (In Italian).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

In a study of the accumulation dynamics of ^{67}Ga, blood, urine, and surface measurements of the liver, spleen, bones, and tumor sites and whole-body scintigraphy were made on 10 controls and 29 patients with systemic illnesses. In comparison with the controls, the ^{67}Ga disappeared faster from the plasma than from the trichloroacetic acid plasma precipitate in the patients with systemic illnesses. The patients and the controls eliminated approximately the same amount of radioactivity in the urine. On the basis of these results it can be assumed that the high ^{67}Ga enrichment in systemic illness occurs primarily through the non-protein bound ^{67}Ga fraction. The kinetics of the radioactivity in the individual organs shows an increased accumulation in the spleen. Additional scintigraphic diagnosis of patients with various types of tumors and in 15 cases without malignancies were interpreted for the evaluation of the certainty of scintigraphic location diagnosis. (tr-auth)

20141 CLINICAL AND BIOCHEMICAL STUDIES ON THE MAMMA-Ca OF HUMANS WITH ^{67}Ga. Deckner, K.; Becker, G.; Fledmann, H. U.; Langowski, U.; Schmidt, C. G. (Rubr-Univ., Bochum, Ger.). Nucl.-Med., Suppl.; No. 12, 489-491(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The distribution of ^{67}Ga in tumors was investigated on human mamma-ca cells, Ehrlich ascites tumor cells in the mouse, and Novikoff hepatoma ascites tumor cells of the rat, and normal tissues of the mouse and rat. The results showed that the distribution pattern in these tissues show quantitative variations primarily concerning the cytoplasmic fraction. The scintigraphic imaging of a tumor with ^{67}Ga depends essentially on the extent of the binding of the isotope to cytoplasmic macromolecules, which are probably proteins. (JSR)

20142 COMPARATIVE DIAGNOSTIC VALUE OF PULMONARY SCINTIGRAPHY USING $R^{131}ISA$-MAA AND ^{67}Ga. Sawas-Dimopoulou, C.; Anezyris, N.; Dermentzoglou, F.; Samara, V. (Hospital Saint-Sawas, Athens). Nucl.-Med., Suppl.; No. 12, 492-495(1974). (In French).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

A comparative study was made of the effectiveness of R[131]ISA-MAA and of ^{67}Ga in the diagnosis of various malignant and benign pulmonary tumors. A total of 36 patients were examined, of whom 31 had primary and secondary carcinomas and five had different benign tumors. The results obtained are tabulated and show that the ^{67}Ga results were negative in four cases of primary cancer and in all the benign tumors. All tumors had positive readings from the labeled albumin macroaggregates. The two methods therefore can be used to complement each other. (JSR)

20143 ^{67}Ga SCANNING IN ASSESSING THE EFFECTIVENESS OF THERAPY AND DETECTION OF TUMOR RECURRENCE. Sawas-Dimopoulou, C.; Anezyris, N.; Koutras, G.; Dermentzoglou, F.; Samara, V. (Saint-Sawas Hospital, Athens). Nucl.-Med., Suppl.; No. 12, 496-499(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The purpose of this investigation of patients with malignant diseases was to study the effects of therapy by comparing ^{67}Ga scintiscans before and after therapy, to determine the nature of uncertain radiological chest opacities by performing new scans months and years after the initial treatment, and to supply additional information regarding the detection of radiologically and clinically unknown tumor processes by follow-up studies. Gallium-67 scintigraphy was found to be a useful method for testing the efficacy of the therapy applied and for detecting local recurrence and metastases of the tumor. (ERB)

20144 ^{67}Ga-CITRATE ACCUMULATION IN PATIENTS WITH MALIGNANT AND NON MALIGNANT DISEASES. Karamourtzounis, J.; Giannoulopoulos, A.; Papantonopoulos, G.; Pontifex, G. (University Aretaon Hospital, Athens). Nucl.-Med., Suppl.; No. 12, 500-505(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Gallium-67-citrate was used for scintigraphic tumor and non tumor localization in 149 patients with a variety of malignant, benign, and inflammatory lesions. The following conclusions could be drawn from this study: ^{67}Ga-citrate is not a tumor specific radiopharmaceutical at present; ^{67}Ga-scanning was noted to be valuable, in the diagnosis of bronchogenic carcinoma, however, active pulmonary inflammation, such as pneumonitis, tuberculosis, abscess of the breast, and also osteomyolitis, and fibrous dysplasia, showed positive scans; concentration of ^{67}Ga in non malignant lesions was found in 33 patients and the absence of ^{67}Ga accumulation was found in 21 patients post radiotherapy and post operatively; when the ^{67}Ga localized in tumors, not all of the tumor mass within the body of the patient, showed such accumulation, suggesting that variation in metabolic activity or vascular perfusion of the lesion, were responsible for the localization; ^{67}Ga-citrate shows a substantial tumor accumulation independent of the tumor type; and the results of our studies, suggest, that chelated carrier-free metals, will prove clinically useful, in evaluating the presence and distribution of malignant neoplastic tissue in humans. Further studies are necessary, to differentiate, between malignant-neoplastic and inflammatory lesions. (auth)

20145 EXPERIMENTAL STUDIES ON THE USE OF ^{113m}In-(PENTADIONE-2,4)$_3$ COMPLEXES FOR LIVER SCINTIGRAPHY. Sinn, H.; Selmair, H.; Georgi, P.; Maier-Borst, W. (Deutsche Krebsforschungszentrum, Heidelberg). Nucl.-Med., Suppl.; No. 12, 514-516(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The distribution pattern of ^{113m}In-(pentadione-2,4)$_3$ complex was determined in the blood, lungs, liver, spleen, brain, heart muscle, kidneys, fatty tissue, skeleton muscles, bones, and large and small intestine of the rat after injection. The results show that only the lungs, liver, and spleen accumulate the complex. The liver has 50% of the injected activity. In the use of this complex in liver scintigraphy of over 700 patients, no intolerances were observed and no false values were obtained. (JSR)

20146 ^{153}Sm-DTPA FOR THE DETERMINATION OF KIDNEY FUNCTION. Zita, G.; Uiberrak, H.; Molnar, G.; Pal, I. (Medizinische Univ., Vienna). Nucl.-Med., Suppl.; No. 12, 517-522 (1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The effectiveness of ^{153}Sm-DTPA for the determination of kidney function was tested on 50 patients and compared with other labeled compounds. The studies showed that it is equivalent to other compounds in the diagnosis of kidney function and had no advantages over them. Attempts to develop a method for double tracer studies were unsuccessful. (JSR)

20147 RADIOIMMUNOELECTROOSMOPHORESIS: APPLICATIONS TO VIROLOGY. Tsotsos, A.; Corbitt, G. (Univ. of Manchester, Eng.). Nucl.-Med., Suppl.; No. 12, 524-527(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The development of radioimmunoelectroosmophoresis (RIEOP), a technique combining immunoosmophoresis (IEOP), which is commonly considered to be the most rapid in providing the results and perhaps the most sensitive out of all known immunodiffusion techniques, with radioactive labeling of the immune reactants and subsequent autoradiographic registration of the immune precipitation lines, is reported. Carbon-14 labeling appears suitable for sufficiently concentrated viral antigens, however, ^{35}S labeling is much more efficient when a higher sensitivity is required. This gain in sensitivity may, however, envolve a parallel loss in the sharpness of the precipitation pattern. (ERB)

20148 CLINICAL APPLICATION OF THE RADIOIMMUNOLOGICAL DETERMINATION OF TRIIODOTHYRONINE. Wenzel, K. W.; Meinhold, H.; Oeff, K. (Freie Univ., Berlin). Nucl.-Med., Suppl.; No. 12, 528-531(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Clinical evaluation of the radioimmunological determination of the T_3 concentration in the serum indicated that this method represents a valuable expansion of diagnostic possibilities. It can, however, only be made in large centers where the necessary equipment is available. (JSR)

20149 RADIOIMMUNOASSAY OF TRIIODOTHYRONINE IN GRAVES-BASEDOW DISEASE: IMPORTANCE OF CHANGES IN THE T_3/T_4 RATIO. Nauman, J.; Nauman, A. (Center for Postgraduate Medical Education, Warsaw). Nucl.-Med., Suppl.; No. 12, 532-534(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The present study shows that metabolism of T_3 is deeply disturbed in Graves-Basedow disease. The preferential stimulation of biosynthesis and release of T_3 by LATS and others stimulators perhaps lymphocytes was already suggested. Although in our study positive results of LATS bioassay was found in 15 of 22 hyperthyroid and 8 of 12 euthyroid unsuppressibility of thyroid gland and hypertriiodothyroninemia support the existence of pathological stimulation in almost all cases. Close agreement between unsuppressibility and diminished T_4/T_3 ratio suggests that value of ratio below 20 in Graves-Basedow disease might be proof for pathological stimulation itself and that in vivo use of ^{131}I as well as exogenous T_3 can be avoided in clinical practice. Significantly elevated level of T_3 in serum of patients with Graves-Basedow disease who are clinically euthyroid and who have normal BMR values is most striking factor. Although hypertriiodothyroninemia without hyperthyroidism was previously reported in some patients with autonomous nodules of thyroid gland, the study performed in Graves-Basedow disease shows that volume of distribution and fractional turnover rate also remain pathologically changed in clinically euthyroid patients. All these data suggest that possibility of changes in cellular receptor sites for T_3 has to be considered in inactive form of Graves-Basedow disease. It is also possible that our present understanding of euthyroid state is still partly unclear. (auth)

20150 PRINCIPLES OF THE RADIOIMMUNOCHEMICAL MEASUREMENT OF THYROID HORMONES AND TBG. Hesch, R. D.; Huefner, M.; von zur Muehlen, A. (Medizinische Univ., Goettingen, Ger.). Nucl.-Med., Suppl.; No. 12, 535-540(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The principles of the immunochemical measurement are discussed from four aspects: preparation of antibodies against T_3 and T_4; prevention of the binding of T_3 and T_4 to TBG; quality of the labelled hormone; and separation methods. (JSR)

20151 QUANTITATIVE DETERMINATION OF TRIIODOTHYRONINE AND OTHER IODOAMINO ACIDS IN PLASMA AFTER COLUMN CHROMATOGRAPHIC SEPARATION. Gehring, D.; Storm, K.; Schultz, W.; von Klein-Wisenberg, A.; Hoffmann, G. (Medizinische Univ., Freiburg i. B.). Nucl.-Med., Suppl.; No. 12, 541-545(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The previously reported method for the quantitative determination of triiodothyronine and other iodoamino acids in blood, based on spiking the plasma sample, extraction of the amino acids, column chromatographic separation of the acids, determination of the radioactivity in the elution fraction, and determination of the iodine in the individual amino acid fractions, is summarized. The values obtained for the amino acids in 19 patients are compared with the results obtained by other methods. The comparisons indicate the reliability of the method. (JSR)

20152 DIAGNOSTIC VALUE OF RADIOIMMUNOLOGICAL INSULIN DETERMINATION. Bottermann, P.; Hoer, G.; Krenzlin, N.; Pabst, H. W. (Technische Univ., Munich). Nucl.-Med., Suppl.; No. 12, 546-548(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The diagnostic value of the radioisotope tracer techniques for in vitro insulin determination in routine clinical practice is critically evaluated from the viewpoint of the variability of serum insulin levels in different types of diabetes and diabetic patients of different ages. (JSR)

20153 ADVANTAGES AND DISADVANTAGES OF INDIVUDUAL METHODS OF RADIOIMMUNOLOGICAL SERUM INSULIN DETERMINATION. Bottermann, P.; Hoer, G.; Ermler, R.; Gebhardt, I.; Pabst, H. W. (Technische Univ., Munich). Nucl.-Med., Suppl.; No. 12, 549-551(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The advantages and disadvantages of the double antibody radioisotope labelling method and the immunosorbent method for serum insulin determinations for the diagnosis of diabetes are critically compared. (JSR)

20154 CARBOHYDRATE METABOLISM AND GROWTH HORMONE SECRETION IN PATIENTS UNDER EXTENDED DIALYSIS TREATMENT. Tourkantonis, A.; Jontofsohn, R.; Herb, H. M.; Heinze, V.; Schroeder, K. E.; Raptis, S. (Univ., Freiburg, i. B.). Nucl.-Med., Suppl.; No. 12, 552-557(1974). (In Germany).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The relation between growth hormone (STH) secretion and carbohydrate metabolism in chronically dialyzed patients was studied in 30 patients using in vitro radioisotope tracer methods. No direct relation was found between the carbohydrate metabolism and observed changes in the STH levels during glucose injection. (JSR)

20155 RADIOIMMUNOLOGICAL DETERMINATION OF GROWTH HORMONE IN PATIENTS WITH ACROMEGALY BEFORE AND AFTER TREATMENT. Bottermann, P.; Hartmann, C. P.; Hoer, G. (Technisch Univ., Munich). Nucl.-Med., Suppl.; No. 12, 558-562(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The clinical value of the radioimmunoassay of the growth hormone (STH) in patients with acromegaly is discussed. It was concluded that the method permits the detection of increased STH levels in these patients and proves directly the diagnosis made by clinical and x-ray methods. It allows a direct evaluation of the results of a therapy course. It gives, in association with function tests, an insight into the hypothalmic-hypophysic control of STH secretion and can possibly contribute to the expansion of knowledge on the pathophysiology of endocrinally active tumors. (JSR)

20156 BEHAVIOR OF THE GROWTH HORMONE IN SERUM AFTER INSULIN AND ARGININE IN CHILDREN WITH SMALLER GROWTH OF UNKNOWN ORIGIN. Siafarikas, K.; Glaubitt, D.; Kosenow, W. (Staedtische Krankenanstalten, Krefeld, Ger.). Nucl.-Med., Suppl.; No. 12, 563-568(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

In 8 children aged from 5 to 14 years with a body height under the third percentile, the kinetics of the growth hormone (STH) concentration in the serum as determined by radioimmunoassay after stimulation by intravenous injection of insulin or intravenous infusion of arginine monochloride were studied as an indication of the growth hormone reserves. The results in 6 children indicated that a lack of growth hormone was not the source of retarded growth. In 2 children, in which the kinetics of the growth hormone concentration behaved synonymously, a partial lack of growth hormone could not be excluded. (tr-auth)

20157 RADIOIMMUNOASSAY DETERMINATION OF DIGOXIN SERUM IN CARDIAC FAILURE. Constantinides, C.; Moulopoulos, S.; Mavrikakis, M.; Chrissikou, M.; Kostamis, P. (Univ. of Athens) Nucl.-Med., Suppl.; No. 12, 569-573(1974).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The determination of the optimal digitalis dose in patients with heart failure has been the main problem to the clinicians since the discovery of the drug. Digitalis radioimmunoassay appears to offer a more accurate basis upon which the effect of the drug on heart failure can be quantitatively correlated to serum levels. Serum digoxin levels were repeatedly determined in patients with heart failure in order to assess the effect of daily intravenous administration as well as the effect of concomitant use of diuretics. (auth)

20158 EXPERIENCES WITH A RADIOIMMUNOLOGICAL METHOD FOR THE DETERMINATION OF TESTOSTERONE SERUM WITHOUT CHROMATOGRAPHY. Wiedemann, M.; Doering, G.; Bauer, H. J.; Karl, H. J.; Raith, L. (Univ., Munich). Nucl.-Med., Suppl.; No. 12, 574-577(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

A radioimmunoassay method using labelled steroids and without use of chromatography was successfully applied to the determination of testosterone in the serum of healthy, hypogonad, and orchidectomized males. The results showed that the method is suitable for the clarification of endocrine testis function. A reliable determination of the testosterone level in the serum of women is not possible with this method. (tr-auth)

20159 COMPARATIVE HPL DETERMINATIONS BY 3 METHODS IN PREGNANT WOMEN. Glaubitt, D.; Schmermund, H. J.; Kuesters, I. (Freie Univ., Berlin). Nucl.-Med., Suppl.; No. 12, 578-583(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Comparative determinations of human placental lactogen (HPL) concentration in the serum of pregnant women with three different radioimmunoassay test kits gave sufficient agreement for clinical purposes. In 22 pregnant women double determination gave a favorable correlation coefficient in all three methods. (tr-auth)

20160 EVALUATION OF RADIOIMMUNOLOGICAL DETERMINATION OF HUMAN PLACENTA LACTOGEN (HPL) FOR THE MONITORING OF RISKY PREGNANCIES. Scholz, K.; Landurner, D.; Riccabona, G. (Univ., Frauen-Klinik, Innsbruck). Nucl.-Med., Suppl.; No. 12, 584-587(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The HPL (human placental lactogen) radioimmunoassay for monitoring risky pregnancies was evaluated on 301 normal and interrupted pregnancies and the value of the method for obstetrical practice was defined. A very good correlation was found between the HPL value and the placenta weight. There is a clear decrease of the HPL value beginning with the 36th week of pregnancy. Typical curves for the clinical significance of HPL determinations are shown for various insufficiencies. The results showed that the method is a valuable tool in monitoring risky pregnancies. (JSR)

20161 STUDIES OF THE HUMAN CHORIONIC SOMATOMAMMOTROPIN PLASMA LEVELS IN NORMAL AND ABNORMAL PREGNANCIES. Grebe, S. F.; Eckhardt, H. J.; Wolf, C. H.; Atassi, A. R.; Roemer, M. (Justus Liebig Univ., Giessen, Ger.). Nucl.-Med., Suppl.; No. 12, 588-593(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

A reduced HCS (human chorionic somatomammotropin) level can indicate a risk for the fetus. However the clinical diagnosis must be considered and the results of the HCS determination checked since normal pregnancies can also show a low HCS level. Only a decreasing HCS value corresponds to a possibility of injury. Since a large part of the pathological pregnancy courses show normal values, the values must be checked in these cases also. The fact that normal pregnancies can have low and pathological HCS values limits the diagnostic value of the radioimmunoassay method and indicates that some unknown factor must be present. (tr-auth)

20162 NEW DATA FOR RADIOIMMUNOASSAY FOR THE DETECTION OF ANTIGENS OF THE HEPATITIS B VIRUS.

Matson, E. J. (Abbott Labs., North Chicago, IL). Nucl.-Med., Suppl.; No. 12, 594-597(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Areas in which radioimmunoassay tests should be routine for the detection of hepatitis-B virus antigens are briefly summarized. The recent development of the moving electrophoresis and Austria-125 test and the specificity and objectivity of these radioimmunoassay methods are discussed. (JSR)

20163 STUDIES ON THE REACTION KINETICS AND SPECIFICITY OF RADIOIMMUNOASSAY (^{125}I-AUSRIA) FOR THE DETECTION OF HEPATITIS B ANTIGEN IN HUMAN SERUM. Zeidler, U.; Deicher, H.; Hultsch, E.; Kuse, M.; Mueller, R. (Medizinische Hochschule, Hanover). Nucl.-Med., Suppl.; No. 12, 598-601(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Studies were made to determine if the radioimmunoassay method for the detection of hepatitis B antigen in human serum could be shortened by variation of the reaction conditions without loss of sensitivity. The factors studied were the incubation temperature and incubation time. The results show that it is possible to shorten the pre-incubation time by one hour if the temperature is increased to about 40°C. The specificity of the test is discussed. (JER)

20164 RADIOIMMUNOLOGICAL DETERMINATION OF CALCITONINE: STUDY OF THE SECRETION OF C CELLS IN VARIOUS GROUPS OF PEOPLE WITH Ca BURDEN. Bieler, E. U.; van Rooyen, R. J. (Atomic Energy Board, Pretoria). Nucl.-Med., Suppl.; No. 12, 602-605(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

Studies were made on healthy persons and on persons after thyroidectomy and hypophysectomy or ^{90}Y implantation for ablation of the pituitary gland in order to determine whether thyreocalcitonin has the same significance for men as for experimental animals. The results show that calcitonin was only seldom detectable in the blood serum of normal individuals by radioimmunoassay. Therefore a direct linear relation between Ca level and calcitonin secretion was not found in adult humans. Calcitonin secretion was greatly modified by thyroidectomy and hypophysectomized patients were found to react with a prompt calcitonin secretion to hypercalcemia. (JSR)

20165 DETERMINATION OF THE ACTIVITY CONCENTRATION OF THE AIR SPACE IN NUCLEAR MEDICAL STUDIES WITH ^{133}Xe. Kretschko, J.; Bofilias, J. (Technische Univ., Munich). Nucl.-Med., Suppl.; No. 12, 643-646(1974). (In German).

From 11th international annual meeting of the German Society of Nuclear Medicine; Athens, Greece (24 Sep 1973). See CONF-730944-.

The activity concentration of radioactive gases can be directly and easily determined by the use of an ionization chamber. The detection limit for ^{133}Xe is 0.4 pCi/cm^3 for a chamber volume of 2000 cm^3 and a zero current of 10^{-14} amp. In various nuclear medical studies of lung function with ^{133}Xe the activity concentration of the radioactive rare gas in the air was determined by this method. The results showed that in most cases the activity concentration was under the maximum permissible concentration of 12 pCi/cm^3. This value can however be exceeded under unfavorable conditions so that precautions must be taken for the protection of medical personnel. (tr-auth)

20166 PITFALLS IN THE APPLICATION OF DIGOXIN DETERMINATIONS. Shapiro, B.; Kollmann, G. J.; Heine, W. I. (Albert Einstein Medical Center, Philadelphia). Semin. Nucl. Med.; 5: No. 3, 205-220(Jul 1975).

The radioimmunoassay of digoxin is one of the most important services of the nuclear medicine laboratory. Precision and accuracy in the performance of the test are especially critical. A number of commercial kits are available and reliable. Pitfalls to be avoided include limited availability or delay in performance of the assay; failure to consider sensitizing factors; drawing the blood sample too soon after a digoxin dose; failure to consider desensitizing factors; forgetting that renal function is a major determinant of blood and tissue digoxin levels; assuming patient compliance and uniform intestinal absorption (bioavailability) with all digoxin preparations in all patients; attempting to interpret digoxin levels without the necessary clinical information; and failure to deliver the result to the proper person. If one avoids these pitfalls, an important service will be rendered in the evaluation of the patient requiring digitalis therapy. (auth)

20167 RADIOIMMUNOSSAY AND THE HORMONES OF THYROID FUNCTION. Stahl, R. J. (College of Medicine and Dentistry of New Jersey, New Brunswick). Semin. Nucl. Med.; 5: No. 3, 221-246(Jul 1975).

Radioimmunoassay (RIA) has provided the tools for wide-reaching investigations that have changed and continue to change many important concepts of thyroid physiology and pathophysiology. The RIA for human thyrotropin (TSH) was developed in 1965; development of the RIA for triiodothyronine (T_3), thyroxine (T_4), thyroxine-binding globulin (TBG), and recently, thyrotropin-releasing hormone (TRH) and thyroglobulin (Tg) followed. The capacity to measure nanogram and picogram concentrations with relative ease and speed has permitted the demonstration of dynamic relationships of the intrathyroidal and circulating thyroid hormones to each other and to the pituitary and hypothalamic regulating hormones. Evidence for the presence of cross-influences between TRH and other hypothalamic regulating hormones on the secretion of pituitary hormones has accumulated. The impact of the new information on clinical practice is now becoming evident. There is new appreciation of the value of assaying serum T_3 and TSH concentrations in the clinical management of patients with disturbed function of the thyroid, pituitary, or hypothalamus. The necessary components for RIA performance can be purchased separately or in kit form from commercial sources. With appropriate quality-control procedures, precise, sensitive, and reliable data can be generated. Awareness of the specific technical problems relating to the RIA of these hormones is absolutely necessary to assure reliable results. The availability of kits or their components permits the performance of these studies in the community hospital and in reliable commercial-service laboratories. (auth)

20168 CLINICAL SIGNIFICANCE OF GASTRIN RADIOIMMUNOASSAY. Walsh, J. H. (Univ. of California, Los Angeles). Semin. Nucl. Med.; 5: No. 3, 247-254(Jul 1975).

Serum gastrin radioimmunoassay (RIA) is a sensitive and specific method suitable for measurement of circulating concentrations of this peptide hormone, which is a major regulator of gastric acid secretion. When performed under optimal conditions this RIA permits measurement of low and normal serum gastrin levels and changes that occur after physiologic stimulation. Hypergastrinemia may be secondary to atrophy of the acid-secreting gastric mucosa. This form of hypergastrinemia is appropriate and leads to no serious consequences. Hypergastrinemia associated with gastric acid hypersecretion is inappropriate. The major cause is a gastrin-secreting tumor (gastrinoma) that produces the clinical picture of the Zollinger-Ellison syndrome. The differential diagnosis of inappropriate hypergastrinemia includes antral G-cell hyperplasia and isolated retained antrum. Accurate diagnosis of these conditions may be aided by ancillary studies including feeding, secretin, and calcium stimulation tests. Distinction among these conditions is important in planning appropriate surgical treatment. (auth)

20169 CURRENT STATUS OF CARCINOEMBRYONIC ANTIGEN ASSAY. Chu, T. M. (State Univ. of New York, Buffalo). Semin. Nucl. Med.; 5: No. 3, 255-262(Jul 1975).

The carcinoembryonic antigen (CEA) is a glycoprotein that can be measured by radioimmunoassay and other immunologic techniques. The CEA reagent is currently commercially available in kit form and has been found to be satisfactory for laboratory use. The highest percentage of elevated plasma CEA and the highest CEA titer have been found in patients with entodermally derived tumors. CEA has also been detected in patients with other tumors and in patients with nonneoplastic disease, as well as in heavy cigarette smokers. The present CEA assay cannot be used to screen for cancer in the general population. The greatest clinical usefulness of current CEA assay is in assessing prognosis, in the detection of residual tumors and recurrent disease, and in monitoring chemotherapy and radiotherapy. The use of anti-CEA antiserum as a tumor-localizing agent may be of potential value in the future. (auth)

20170 RADIOLIGAND ASSAY IN REPRODUCTIVE BIOLOGY. Korenman, S. G. (Univ. of California, Los Angeles); Sherman, B. M. Semin. Nucl. Med.; 5: No. 3, 263-272(Jul 1975).

Radioligand assays have been developed for the principal reproductive steroids and peptide hormones. Specific binding reagents have included antibodies, plasma binders, and intracellular receptors. In each assay, problems of specificity, sensitivity, and nonspecific inhibitors were encountered. Many features of the endocrine physiology in childhood, during puberty, and in adulthood have been characterized. Hormonal evaluations of endocrine disorders of reproduction are characterized on the basis of their characteristic pathophysiologic alterations. (auth)

20171 CRITICAL REVIEW OF THE CLINICAL RELEVANCE OF GROWTH HORMONE AND ITS MEASUREMENT IN THE NU-

CLEAR MEDICINE LABORATORY. Brown, G. M.; Kirpalani, S. H. (Clarke Inst. of Psychiatry, Toronto). Semin. Nucl. Med.; 5: No. 3, 273-285(Jul 1975).

A wide variety of metabolic and stressful stimuli, both physical and psychologic, produce rapid elevation of plasma growth hormone (GH). In addition, spontaneous elevation of GH occurs during the day, and a rise in GH occurs in association with the initial slow-wave sleep episode at night. Although the identity of the long-sought GH releasing factor has not yet been established, a hypothalamic factor inhibiting GH release named somatostatin has been identified and synthesized. Most, if not all, of the GH rises are mediated by neural mechanisms, and therefore they may be disrupted by many disease processes affecting the pituitary or the hypothalamus. In acromegaly, hypersecretion of GH occurs, and remnants of hypothalamic control can frequently be demonstrated, suggesting a hypothalamic origin for at least some cases. Provocative stimuli commonly used to assess adequacy of GH responses include hypoglycemia, arginine infusion, and exercise. Administration of L-dopa or apomorphine also produces GH elevation, and since these agents may activate specific dopamine mechanisms, they are of particular interest. Two comprehensive commercial kits have been evaluated, and three major defects have been identified. The literature provided in both kits was inadequate. Both kits required an initial dilution without any replication, so that dilution error would be undetected. One of the kits did not provide a full complement of materials. Quantities of HGH antigen and antisera sufficient for large numbers of assays are also available commercially. However, no commercial source was found for control sera containing known quantities of HGH. It will be necessary for individual laboratories to provide their own supply of sera to use for quality control. It is now known that GH exists in multiple forms in plasma and that antisera may differ in ability to bind these forms. It will, therefore, be necessary for laboratories to revalidate the assay if a different antiserum is used. (auth)

20172 USES AND LIMITATIONS OF RADIOISOTOPES IN THE INVESTIGATION OF GASTROINTESTINAL DISEASES. Braunstein, P.; Song, C. S. (New York Univ., NY). Am. J. Dig. Dis.; 20: No. 0, 53-90(Jan 1975).

Advances in the physical and biological sciences have in recent years led to a rapidly increasing use of radioactive agents in clinical medicine. The distinctive properties of these agents have made them invaluable for a large variety of unique in vivo and in vitro diagnostic tests. In order to help the clinician employ such tests productively and realistically, an attempt was made to review the present status of radioisotopes with regard to gastrointestinal diseases. Emphasis was placed not only on their value but also on their limitations; the degree of safety for in vivo application has also been briefly considered. (117 references). (auth)

20173 SCINTIGRAPHIC PICTURE OF THYROID NODULES AFTER ^{99m}Tc AND ^{131}I ADMINISTRATION. Wojciechowski, J.; Krzeminska, T.; Gasiorowski, W. Endokrinol. Pol.; 26: No. 2, 179-190(1975).

In 21 patients with thyroid nodules, scintigraphic examinations of the thyroid were carried out after ^{99m}Tc and subsequent ^{131}I administration. Obtained results were compared: in 13 patients scintigraphic pictures after both agents showed no difference. In 3 patients thyroid scintiscan was better after ^{99m}Tc, while in another 5 patients better results were obtained with ^{131}I. In the course of examinations there was noticed, that changed technic conditions frequently allowed to visualise in scintigram the extranodular parenchyma of "not" thyroid nodules without subsequent TSH administration. The examined material allows to conclude that scintigraphic pictures after ^{99m}Tc and ^{131}I are in the majority of cases similar. Iodine-131 as an element taking part in all physiological processes is more suitable, for scintigraphic examination. Technetium-99m has the advantage of lower radioactivity dose to the examined person; and this is why it has a priority in children and the young. (auth)

20174 AN EXPERIMENTAL STUDY ON THE MECHANISM OF REPAIRING IN INJURED ARTICULAR CARTILAGE OF YOUNG, YOUNG ADULT, AND ADULT RATS. Maki, Y. (Kyoto Prefectural Univ. of Medicine (Japan)). Nippon Seikei Geka Gakkai Zasshi; 48: No. 6, 351-364(Jun 1974). (In Japanese).

It is the purpose of this study to investigate the mechanism of repairing of V shaped injury inflicted on the articular cartilage of the condyles of the femur of young, young adult, and adult rats. The process of repairing in injured articular cartilage was studied by the combined histological and the autoradiographic methods. The histological study was carried out under hematoxylin eosin, van Gieson and toluidin blue staining. The autoradiographic study was done using ^{3}H-thymidine, by either cumulative or pulse labeling method. In young rats, the defect of injured articular cartilage was filled temporarily with undifferentiated mesenchymal cells but the injured articular cartilage was repaired with cells of articular cartilage under reactive division. In young adult rats, it was repaired mainly with the cartilage which differentiated from the undifferentiated mesenchymal cells. In adult rats, satisfactory repair was difficult because the wound was filled with connective tissue in the superficial layer and with bone tissue in the deep layer. These infiltrating tissues differentiated from undifferentiated mesenchymal cells. According to the findings described above, it was suggested that the repairing mechanism of the injured articular cartilage was assumed to be different depending on the aging of the individuals. (auth)

20175 A PROPOSAL OF A PROGRAM FOR PROCESSING SCINTIGRAMS. Smoothing, Separating, Character Selecting, and Display. Yasukochi, H. (Koshigaya City Hospital, Saitama (Japan)); Machida, K.; Ohshima, M.; Sugawara, T.; Kumura, F. Kaku Igaku; 11: No. 6, 647-655(Dec 1974).

In this report we demonstrate a program for the treatment of scintigrams by scanner. In this program, to avoid the unnecessary economical risks, any non-routine procedures are eliminated from the program. Scintigram data from a scintiscanner (Toshiba 3'') were punched in a paper tape by every 5 mm intervals, and set in a tape reader which is connected by telephone line to TOSBAC-40-TSS in Tokyo University Hospital 4 km apart from our department. The data were treated by the computer under the control of terminal input/output typewriter which was set in our department and the result was returned to our department through the same input/output typewriter by telephone line and the processed scintigrams were printed out. The program is usually performed as demonstrated in figure. They are initial load, smoothing, selecting character, separating, and display. Histograms for number of area in each count level are also printed out before and after smoothing and separating as occasion demands. In addition, any procedures could be passed or returned to any part according to the purpose. The digital scintigram is printed out after all procedures with selected characters for each level, which are composed of one or two superimposed ones. (auth)

20176 RADIONUCLIDE ANGIOCARDIOGRAPHY. Treves, S.; Maltz, D. L. (Harvard Medical School, Boston). Postgrad. Med.; 56: No. 1, Jul 1974.

Radionuclide angiocardiography is a useful noninvasive technique for evaluating cardiopulmonary hemodynamics. It is simple to perform, requiring only peripheral intravenous injection of a radionuclide and external detection. Both anatomic and numerical data are available simultaneously. Radionuclide angiocardiography allows accurate detection and quantitation of left-to-right shunts without the need for catheterization. Multiple physiologic factors can be evaluated simultaneously with a single injection of radioisotope. Progress in nuclear instrumentation and radiopharmaceutical development should overcome some of the present limitations of radionuclide angiocardiography. As its potentials become more widely known to physicians, its clinical applications should expand. (auth)

20177 BRAIN SCANNING. Mandell, C. (Rhode Island Hospital, Providence). R. I. Med. J.; 57: 286-291(Jul 1974).

The brain scan offers a simple, sensitive, and atraumatic evaluation of suspected intracranial pathological conditions. Utilizing a variety of diagnostic approaches, including new radiopharmaceuticals, the physician in nuclear medicine is frequently able to modify the technique for a particular individual problem. With proper use, the clinician may expect the scan to yield a high return of important diagnostic information. (auth)

20178 RADIOIMMUNOASSAY FOR RHESUS MONKEY GONADOTROPINS. Faiman, C.; Stearns, E. L.; Winter, J.S.D.; Reyes, F. I.; Hobson, W. C. (Univ. of Manitoba, Winnipeg). Proc. Soc. Exp. Biol. Med.; 149: No. 3, 670-676(Jul 1975).

Heterologous double-antibody radioimmunoassay methods are described for the measurement of circulating levels of rhesus monkey (Macaca mulatta) FSH and LH; the latter assay is also applicable to rhesus chorionic gonadotropin (CG) estimations. The FSH assay utilizes purified rat FSH for trace, either of two anti-human FSH antisera and a semipurified rhesus pituitary standard. The LH assay utilizes purified ovine LH for trace, an anti-human CG antiserum and the same rhesus pituitary standard. The use of these systems obviates the necessity of purifying rhesus gonadotropins which are required for the development of homologous radioimmunoassay systems. (auth)

20179 BRAINSCANNING WITH RADIOINDIUM: A CRITICAL REVIEW. Burrows, E. H. (Wessex Neurological Centre, Southhampton, Eng.). Neuroradiology.; 2: 15-23(Mar 1971).

The clinical utility of radioindium in cerebral scintigraphy is evaluated on the basis of a series of 600 cases including 240 proven lesions. Out of the 240, one group of 70 were also examined with radiomercury-197, and another group of 38 with radiotechnetium.

The clinical reliability, physicochemical suitability, and, convenience of use of radioindium is discussed and compared with that of radiotechnetium. (auth)

20180 TRIIODOTHYRONINE RADIOIMMUNOASSAY IN UNEXTRACTED SERUM. Rastogi, G. K.; Sawheny, R. C. (Postgraduate Inst. of Medical Education and Research, Chandigarh, India). Indian J. Med. Res.; 62: No. 2, 225-232(Feb 1974).

A direct, sensitive, reproducible, and rapid radioimmunoassay of 3, 5, 3', triiodothyronine (T_3) in the serum has been described using double antibody technique. The specific T_3 antiserum was raised in rabbits by injecting T_3-BSA conjugate with adjuvant. There was no significant cross reaction with thyroxine. The serum T_3 levels in 56 healthy euthyroid subjects ranged from 1 to 1.8 ng/ml, mean 1.4 ± 0.04 (SEM). There was significant elevation in thyrotoxic patients (4.8 ± 0.52). Hypothyroid patients had significantly lower levels (0.38 ± 0.05), patients with euthyroid goitre did not show a significant variation in serum T_3 levels. (auth)

20181 RADIOISOTOPE SCANNING OF CEREBROSPINAL FLUID PATHWAYS. Tandon, P. N.; Rao, M. A. P.; Pathak, S. N.; Banerji, A. K.; Dar, J. (All-India Inst. of Medical Sciences, New Delhi). Indian J. Med. Res.; 62: No. 2, 281-289(Feb 1974).

Radioisotope scanning of cerebrospinal fluid (CSF) pathways, utilizing ^{131}-I-Human-serum albumin (RIHSA) was carried out during the past three years on 103 patients with a variety of lesions affecting the dynamics of CSF flow of absorption. After injection of RIHSA into the lumbar spine, serial scanning was done over the spine for myelography and over the skull for cisternography. For ventriculography, RIHSA was injected directly into the lateral cerebral ventricle. It proved to be a simple, safe, and reliable investigation for evaluating cases of hydrocephalus, congenital malformations of the central nervous system, CSF fistulae, post-operative CSF shunts, sequelae of meningitis, and spinal compression. The investigation is indispensable in differentiating between progressive and arrested hydrocephalus, normal pressure hydrocephalus in adults, and cerebral atrophy. Routine RIHSA scan in cases of congenital malformations of CNS not only helped in the diagnosis but also frequently disclosed associated occult anomalies. In practically all cases of CSF fistulae and spinal compression submitted to this investigation, it correctly outlined the defect. Except for aseptic meningitis in two cases, no other complication was encountered. (auth)

20182 SCINTIGRAPHIC IDENTIFICATION OF COMPLETE THORACIC GOITER WITH NORMAL APPEARING CERVICAL THYROID: A CASE REPORT. Kaplan, W. D.; Watnick, M.; Holman, B. L. (Harvard Medical School, Boston). J. Can. Ass. Radiol.; 25: No. 1-4, 193-195(1974).

An intrathoracic goiter was preoperatively visualized by ^{131}I thyroid scan in an asymptomatic patient presenting with a mediastinal mass on routine chest radiograph. This uncommon lesion, located completely within the mediastinum, evidenced no functional connection to the scintigraphically normal appearing cervical thyroid gland. (auth)

20183 EXAMINATION OF THE INJECTION TO SCANNING INTERVAL WITH ^{18}F AND ^{85}Sr. Asnis, S. E.; Blau, L. M.; Bohne, W. H. (Cornell Univ., New York). J. Can. Ass. Radiol.; 25: No. 1-4, 184-192(1974).

Scintimetry was used to evaluate injection to scanning intervals from one to four hours with ^{18}F and one hour to fourteen days with ^{85}Sr. With ^{18}F the raw four-hour scan showed more diseased to normal bone contrast than the raw one-hour scan. When correction was made by computer for soft-tissue background, the one-and four-hour scans were practically identical. Strontium-85 scans, both uncorrected and corrected for soft-tissue background, generally showed increasing disease to normal bone contrast from one hour to fourteen days. Several negative or equivocal scans done at one and four hours after ^{85}Sr injection became clearly positive in fourteen days. No gross discrepancies were found in ^{85}Sr scans done from one to fourteen days after injection. (auth)

20184 CORRECT OPERATION OF A SCINTILLATION CAMERA IN CEREBRAL SCINTIGRAPHY. Burrows, E. H. (Wassex Neurological Centre, Southampton, Eng.). Neuroradiology.; 5: 77-81(Apr 1973).

In a direct clinical comparison of 137 patients submitted to cerebral scintigraphy with both a scintillation camera and a rectilinear scanner, a complete coincidence of results was obtained—42 positives and 7 false-negatives with both machines. Subjective comparisons of the images obtained from the 42 positive cases indicated that the camera provided a marginally better field of diagnostic information. (auth)

20185 VALUE OF BONE SCINTIGRAPHY WITH ^{87m}Sr IN THE DIAGNOSIS OF INFECTIOUS SPONDYLODISCITIS (OR SPONDYLITIS). Rondier, J.; Cayla, J.; Bok, B.; Bouchareb, A. Rev. Rhum.; 41: No. 6, 427-439(Jun 1974). (In French).

The authors made strontium-87m scintigraphs in 10 patients suffering from infectious spondylodiscitis and in 17 patients with degenerative diskovertebral or dystrophic lesions, the latter being examined for the purposes of comparison. The isotope tests were clearly positive in all patients with developing spondylodiscitis but, on the contrary, were negative in two patients with Pott's disease who were studied when nearly cured. The tests were also negative in 10 patients with diskarthrosis and in seven patients with sequelae of vertebral epiphysitis. Repeated scintigraphic tests, carried out during treatment of four infectious centres, three of which were tuberculous, showed that the intensity of hyperfixation decreased slowly, complete disappearance of the centre being observed only 18 to 24 months after the beginning of antibiotic therapy. These findings, together with results of other published works, confirm that hyperfixation is practically constant, but appears early and is generally intense, in patients with developing spondylodiscitis, while it is unusual and in all cases slight in those with arthrosis or the sequelae of vertebral epiphysitis. One can therefore imagine the practical value of this examination in patients in whom vertebral infection is just developing and is almost undetectable radiologically, in patients with diskarthritis or pseudo-Pott's epiphysitis, and particularly in cases of supposed relapse of old centres of spondylodiscitis. (auth)

20186 EVALUATION OF PERIPHERAL ARTERIAL FLOW WITH RADIOACTIVE ORTHO-IODINE-HIPPURATE. Kauffman, P.; Camargo, E. E.; Dias Neto, A. L.; Wolsker, M.; Carvalho, N.; Puech Leao, L. E. Rev. Hosp. Clin., Fac. Med., Univ. Sao Paulo; 29: No. 6, 311-317(1974). (In Spanish).

Peripheral arterial flow was evaluated using sodium ortho-iodine-hippurate, labeled with ^{131}I. The substance was injected in the arteries of the lower limbs of 20 normal individuals before and after administration of a vasodilating drug. The parameters that were analyzed were the half-lives of blood depuration of the tracer ($T\frac{1}{2}$ and $t\frac{1}{2}$). Before use of a vasodilator, the mean values for $T\frac{1}{2}$ and $t\frac{1}{2}$ were 16.270 and 15.936 sec, respectively, while the values were 12.930 and 13.610 sec after vasodilator administration. (auth)

20187 EXPERIENCES WITH EXAMINATIONS WITH RADIOACTIVE PHOSPHORUS. Bouzek, J. (Ocni Klinika Lekarske Fakulty Ujep, Brno). Cesk. Oftalmol.; 30: No. 5, 381-383(Sep 1974). (In Czech).

The author describes practical experiences with examinations with radioactive phosphorus. He has been using the Soviet detection probe SBM 12. The measurement is carried out 15 and 60 min., 24, 48, and 72 hours after intravenous administration of 500 to 600 μCi of the isotope ^{32}P. (auth)

20188 UTILIZATION OF A SINGLE ANTISERUM FOR THE DIRECT RADIOIMMUNOASSAY OF PROSTAGLANDINS E AND F IN SEMEN AND PROSTAGLANDIN F IN AMNIOTIC FLUID. Clarke, A. H.; Ing, R. M. Y.; Jones, W. R.; Llewellyn-Jones, D.; Shutt, D. A. (Univ. of Sydney). Prostaglandins; 7: No. 5, 433-442(10 Sep 1974).

Antibodies to both prostaglandin F (PGF) and prostaglandin E (PGE) were raised in rabbits after they were immunized with prostaglandin F/sub 2a/ conjugated to bovine serum albumin (PGF/sub 2a/-BSA). The antisera were group specific although the antibodies to the F group of prostaglandins showed greater specificity than those to the E group. The antisera were sufficiently specific however to allow the direct radioimmunoassay of PGF and PGE in human semen and PGF in amniotic fluid during induced abortion. Specificity of the direct radioimmunoassay was checked by chromatographic separation of the prostaglandins prior to analysis. Estimation of the prostaglandins in the semen of 30 men attending the infertility clinic showed that 19 of the men had normal semen levels of PGE and PGF of 68 +- 7 (SE) and 6.0 +- 0.6 mu g/ml respectively, as compared with data on normal fertile males, whilst the other 11 men had lower levels of 16 +- 2 (SE) and 0.8 +- 0.1 mu g/ml respectively. Application of the method to amniotic fluid showed that the PGF concentration in amniotic fluid during the induction of abortion with extra-ovular saline increased from less than 0.6 ng/ml to 6.4 ng/ml when the induction-abortion intervals ranged from 6 to 48 hours. (auth)

MATERIALS

20189 (CONF-740222-) ENGINEERING FOR THE MATERIALS/ENERGY CHALLENGE. Proceedings of the 14th Annual ASME Symposium, Albuquerque, New Mexico, February 28–March 1, 1974. (American Society of Mechanical Engineers. New Mexico Section). 1974. 145p. J. P. Abbin, Albuquerque, NM 87110, $7.50.

Thirty papers were presented at the symposium. An abstract was prepared for each of three papers selected for inclusion in NSA. Papers for which no abstracts were prepared are concerned with biomechanics, geologic materials, and miscellaneous materials. (JRD)

For abstracts of individual papers see: 20301, 20382, and 20383.

20190 (CONF-740570-P4) 8TH PLANSEE SEMINAR, REUTTE, AUSTRIA, MAY 27–30, 1974. Papers and Discussions. IV. (Metallwerk Plansee A. G., Reutte/Tyrol (Austria)). 1974. 163p. (In German and English).

This volume contains 7 papers, 5 of which are in NSA scope, and discussions of all 46 papers. Separate abstracts were prepared for these 5 papers. The remaining two papers are on TiN-base cermets and Cermotherm thermoelements. An index of all 46 papers is also included. (DLC)

For abstracts of individual papers see: 20203, 20281, 20282, 20302, and 20303.

20191 (COO-3478-14) THEORY OF REACTION KINETICS. Final Report, 1 June 1974–31 May 1975. Corbett, J. W.; Peak, D. (State Univ. of New York, Albany (USA)). 1975. 34p. Dep. NTIS $4.75.

Research on the role of spatial correlation in the continuum and discrete lattice reaction kinetics of reacting species is reported. Theories applicable to problems in radiation damage and void formation (vacancy aggregation, nucleation, and growth) as well as in radiation chemistry, photo-chemistry, radiation biology, photobiology, ionization yields, and precipitation in general are being developed. (JRD)

20192 (LA-5937-MS) THERMAL AND OTHER PROPERTIES OF REFRACTORIES. Vier, D. T. (Los Alamos Scientific Lab., N. Mex. (USA)). Apr 1975. Contract W-7405-eng-36. 51p. Dep. NTIS $5.45.

A semi-theoretical treatment is presented that allows a rapid estimate of high-temperature enthalpies and the enthalpies of vaporization and fusion of refractory materials. This treatment gives the enthalpy of a refractory solid, s, at its melting point ($H = H^{\circ}_{T_m}(s) - H^{\circ}_{298}$, J/g) to be $25nT_m/F.W.$, where n is the number of atoms per formula weight F.W., and T_m is the melting point in °K. The heat of fusion is ~0.4 times the enthalpy at the melting point (H), and the heat of vaporization at the boiling point is ~7.6kH/n, where k is the number of moles of gas formed by one F.W. of the material. Enthalpies of the solid at the melting point, the liquid at the melting point, and the vapor at the boiling point are H, 1.4H, and (2.2 + 7.6k/n)H, respectively, each relative to $H^{\circ}_{298}(s)$. The estimation of other properties of refractories is also briefly considered. Selected data on 17 properties of approximately 500 refractories are tabulated. Enthalpies of the solid at the melting point and of the vapor at the boiling point, relative to the solid at 298°K, estimated for these refractories and included in the table of properties. (auth)

20193 FATIGUE OF COMPOSITE MATERIALS. Proceedings of a Symposium Presented in Bal Harbour, Florida, 3–4 December 1973. ASTM Special Technical Publication 569. Philadelphia; American Society for Testing and Materials (1975). 338p. (ASTM-STP-569; CONF-731230-). $31.00.

This conference was focused on phenomena rather than the type of material in order to bring an interdisciplinary prospective to the fatigue problem in heterogeneous materials. The 19 papers are arranged into four sections dealing with crack growth and interfaces; deformation and damage; fracture mechanisms and environmental effects; and prediction, reliability, and design. One separate abstract was prepared for one paper in NSA scope. (DLC)

For an abstract of an individual paper see: 20356.

Ceramics and Cermets

Refer also to abstracts 19344, 19346, 19679, 20254, 20278, 20279, 20368, 20402, 21459, 21499, 21506, and 21730.

20194 (AERE-R-7961) 4TH ACTINIDES COLLOQUIUM, HARWELL, ENGLAND, JUNE 1974. Hall, R. O. A.; Mortimer, M. J. (eds.). (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). 1975. 98p. (CONF-7406103-).

Eleven papers were presented. The materials studied included plutonium, uranium, thorium, and americium and their compounds. The properties investigated included: electronic structure, crystal structure, phase equilibria, electric resistivity, magnetic susceptibility, optical properties, thermal conductivity, specific heat, alloying, radiation damage, spectra. Separate abstracts were prepared for each paper. (UK)

For abstracts of individual papers see: 19370, 20195–20201, 20298, 20299, and 20381.

20195 (AERE-R-7961, pp 45) BONDING AND CRYSTAL RADII IN SIMPLE 3d, 4d, 4f, AND 5f TRANSITION METAL CARBIDES, NITRIDES AND OXIDES. Blank, H. (Institut fuer Transuranium, Karlsruhe, Ger.). 1975.

From 4th actinides colloquium; Harwell, UK (Jun 1974).

In 4th actinides colloquium.

Collecting the bond lengths of simple carbides, nitrides, and oxides of 3d, 4d, 4f and 5f transition metals reveals some characteristic trends. The octahedral and tetrahedral crystal radii of oxygen have been determined for the 4f and 5f oxides, and values for nitrogen and carbon are proposed on the basis of a comparison between bond lengths in oxides, carbides, and nitrides. Since in the cases of oxygen and nitrogen the crystal radii obtained are identical or very close to covalent radii recently deduced by Van Vechten and Phillips, it is concluded that also the carbon radius of these authors can be applied. With the radii of C, N, and O known the metal radii in these structures can be deduced and some indications for a correlation with the 3d-effect can be found. (auth)

20196 (AERE-R-7961, pp 46–65) SOME COMPARISONS OF PHASE EQUILIBRIA BETWEEN THE ACTINIDE AND LANTHANIDE–PLATINUM METAL SYSTEMS AND THE EFFECTS OF CARBON ON THESE EQUILIBRIA. Haines, H. R.; Parnell, D. G.; Potter, P. E. (Atomic Energy Research Establishment, Harwell, Eng.). 1975.

From 4th actinides colloquium; Harwell, UK (Jun 1974).

In 4th actinides colloquium.

There is great interest in the alloys of the lanthanides and actinides with the 2nd row Group VIII elements as such alloys are found in irradiated oxide and carbide fast reactor fuels; for example the alloys of composition MX_3, where M = U, Pu and X = Ru, Rh, Pd with the Cu_3Au face centred cubic structure were reported. In order to predict the factors that influence the constitution of the irradiated fuels it is essential to have a knowledge of the stabilities and phase relationships of the actinide, lanthanide-Group VIII alloys together with an understanding of the effects of both oxygen and carbon on the binary equilibria. These intermetallic alloy compounds are considered in the context of endeavouring to obtain an understanding of the constitution of an irradiated carbide fuel. The intermetallic compounds formed between the lanthanides and actinides with the 2nd and 3rd row Group VIII elements are reviewed in terms of their structure types; the formation of the intermetallic compounds is discussed in terms of electronic and size factors; the available thermodynamic data for these compounds are also reviewed. (auth)

20197 (AERE-R-7961, pp 66–73) INELASTIC NEUTRON SCATTERING STUDIES OF ACTINIDE COMPOUNDS WITH ROCK SALT STRUCTURE. Wedgwood, F. A. (Atomic Energy Research Establishment, Harwell, Eng.); de Novion, C. 1975.

From 4th actinides colloquium; Harwell, UK (Jun 1974).

In 4th actinides colloquium.

An account is presented of inelastic neutron scattering studies of actinide compounds with rock salt structure. The subject is dealt with in two parts: scattering by phonons and magnetic scattering. In the first part, results are shown for ThC, ThN, ThP, ThS, UC, UN, UP, US and USe. In the second part, results are shown for UN, UP, US, USe, UTe. (UK)

20198 (AERE-R-7961, pp 74–87) ELECTRICAL RESISTIVITY AND MAGNETIC SUSCEPTIBILITY OF URANIUM-DILUTE ($Th_{1-x}U_xS$) COMPOUNDS. Haessler, M. (CEN, Fontenay-aux-Roses, France). 1975.

From 4th actinides colloquium; Harwell, UK (Jun 1974).

In 4th actinides colloquium.

In the course of a study of the behavior of the 5f electrons of uranium, the electronic properties of uranium in substitution in ThS were measured. Electrical resistivity and magnetic susceptibility of $U_xTh_{1-x}S$ dilute alloys with x = 0.015, 0.03, 0.06 and 0.125 were measured between 4 K and 300 K. The results are analyzed and discussed. (UK)

20199 (AERE-R-7961, pp 88) SOME CONSIDERATIONS ON THE SPECTROSCOPIC INVESTIGATION OF UO_2 AND U_4O_9 SINGLE CRYSTALS. Manes, L.; Naegele, J. (Institut fuer Transuranium, Karlsruhe, Ger.). 1975.

From 4th actinides colloquium; Harwell, UK (Jun 1974).

In 4th actinides colloquium.

The reflectance spectrum of UO_2 and U_4O_9 single crystals in a wide spectral range was investigated. In the far infrared the vibrational spectrum of the two oxides was measured up to 200 μm. Marked differences were found, that can be interpreted on the basis of the variation of the cell from UO_2 to U_4O_9. Reflectance was measured as a function of temperature for U_4O_9. A marked variation of the static dielectric constant was found, and a model is suggested to interpret it. In the visible and far UV the reflectance spectrum of the two oxides was measured up to 11 eV. A large optical band was found in both cases, probably corresponding to the first interband transition. However, a comparison of the two spectra shows: a widening of the band for U_4O_9; and a shift of the frequency of the maximum of the band to lower energies for U_4O_9. Qualitative hypotheses can be advanced on the basis of the results and other data (electric and magnetic) about the difference in band structure between the two oxides. (auth)

20200 (AERE-R-7961, pp 89-92) SOME REMARKS CONCERNING THE THERMAL CONDUCTIVITY OF PLUTONIUM-AND AMERICIUM-OXIDES. Schmidt, H. E. (Institut fuer Transuranium, Karlsruhe, Ger.). 1975.

From 4th actinides colloquium; Harwell, UK (Jun 1974).

In 4th actinides colloquium.

The thermal conductivity of disc-shaped sintered PuO_2, AmO_2, and Am_2O_3 samples was measured at 60°C by a longitudinal heat flow method. The estimated uncertainty of the measurements was ±15%; measured data were normalized to 95% of the theoretical density by using the Loeb porosity correction. The results obtained with freshly annealed samples (in W/cm°C) were 1.0×10^{-1} for PuO_2, 6.9×10^{-3} for AmO_2 and 8.2×10^{-3} for Am_2O_3. Apparently, the thermal conductivity of the actinide oxides at 60° goes through a minimum at Z = 95, as does the conductivity of lanthanide oxides, though much less pronounced, at the homologous position. Self irradiation damage causes the thermal conductivity of Pu- and Am-oxides to decrease. The $\Delta\lambda/\lambda$-curves for the three materials investigated follow exponential growth equations with identical growth rates if plotted as a function of the number of disintegrated atoms per cm^3. Saturation is attained much faster in $\Delta\lambda/\lambda$ than in lattice parameter change due to self irradiation in both Pu- and Am-oxides. The observed difference in saturation level for the conductivity of AmO_2 and Am_2O_3 has also been observed in the change of lattice parameters of PuO_2 and Pu_2O_3 as a function of storage time. It is concluded that the phonon scattering cross sections of defect clusters which are formed in these materials at sufficiently high self irradiation doses are to a certain extent independent of the number of coalescing defects. Radiation induced conductivity changes in PuO_2 anneal out at 250°C and above 800°C, in accordance with corresponding results of lattice parameter studies. (auth)

20201 (AERE-R-7961, pp 93-98) SOME PRELIMINARY RESULTS ON THE LOW TEMPERATURE SPECIFIC HEAT OF AmO_2. Hall, R. O. A. (Atomic Energy Research Establishment, Harwell, Eng.); Mortimer, M. J.; Mueller, W. 1975.

From 4th actinides colloquium; Harwell, UK (Jun 1974).

In 4th actinides colloquium.

The specific heat of AmO_2 from 25 to 305°K was measured by an adiabatic technique. The experimental apparatus and method are described. The specific heat of AmO_2 after 180 days self-irradiation damage, over the range of measurement, is shown. The room temperature value is about 70j/mole/K, which is consistent with values for UO_2(63.6j/mole/K) and PuO_2(68j/mole/K). (UK)

20202 (ARH-SA-213) PRODUCTION OF CERAMIC GRADE PLUTONIUM DIOXIDE. Peabody, C. M.; Doto, P. C. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). Apr 1975. Contract AT(45-1)-2130. 17p. (CONF-750607-25). Dep. NTIS $4.00.

From American Nuclear Society meeting; New Orleans, Louisiana, USA (8 Jun 1975).

Ceramic grade plutonium dioxide is produced at Hanford using the plutonium(IV) oxalate process. Standards established by the Energy Research and Development Administration define acceptable product characteristics. The production of oxide meeting these standards requires proper feed preparation and control of process parameters regarding the precipitation, filtration, and calcination steps as well as stringent product handling requirements. (auth)

20203 (CONF-740570-P4, pp vp Paper D17) SOME PROPERTIES OF TITANIUM CARBONITRIDE AND EFFECTS OF ADDITION OF V_A AND VI_A ELEMENTS. Yamamoto, T. (Sumitomo Electric Industries Ltd., Itami, Japan); Kieffer, R.; Ettmayer, P. 1974.

From 8th plansee seminar: heat-resisting and wear-resisting sintered materials; Reutte, Austria (27 May 1974).

In 8th Plansee seminar: papers and discussions. IV.

Coarse-grained polycrystalline fcc Ti (C, N) $_{1-x}$ samples with or without a small amount of V_z or VI_z elements were prepared by hot pressing in order to study their properties as a function of C and N content. Results are as follows: (1) Titanium nitride shows its maximum hardness at the substoichiometric composition of $TiN_{0.6-0.7}$, whereas titanium carbide has its maximum hardness within the solid solution region. Ti (C, N)$_{1-x}$ follows the path from $TiN_{0.6-0.7}$ towards TiC. (2) (Ti, V) (C, N)$_{1-x}$, (Ti, Nb) (C, N)$_{1-x}$ and (Ti, Ta) (C, N)$_{1-x}$ generally have a similar tendency in their homogeneity range with respect to variation of lattice parameter and hardness. (3) The two-phase region consisting of two fcc phases appeared not only with molybdenum containing systems but also with chromium and tungsten containing systems. (4) (Ti, Mo) (C, N)$_{1-x}$ or (Ti, W) (C,N)$_{1-x}$. More than 10 at.% Cr can replace Ti in Ti(C, N)$_{1-x}$, where x is between 0.1 and 0.5. This replacement increases hardness of substoichiometric carbonitrides on the (Ti, Cr)C side of the diagram. (auth)

20204 (CONF-750532-1) BIOCERAMICS AND CARBON. Eatherly, W. P. (Oak Ridge National Lab., Tenn. (USA)). [nd]. Contract W-7405-eng-26. 10p. Dep. NTIS $4.00.

From 1st national biomedical engineering conference; Chicago, Illinois, USA (6 May 1975).

A review of the monolithic and pyrolytic forms of carbon is made in view of their properties and applications. These materials are being used in orthopedic, orthodontal, cardiovascular, and transcutaneous applications. The graphite fabrication program at ORNL, and how it progressed to biomedical applications, is briefly described. Carbons and graphites have now been produced that appear to be totally acceptable to the human body. Laboratory and clinical tests show no significant negative responses in either test animals or the human. The materials appear to have lifetimes exceeding that of humans. (MCW)

20205 (COO-2390-8) FIRING: THE PROOF TEST FOR CERAMIC PROCESSING. Kingery, W. D. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Materials Science and Engineering). 1975. Contract AT(11-1-)-2390. 22p. (CONF-750131-1). Dep. NTIS $4.25.

From 10th university conference on ceramic science; Gainesville, Florida, USA (27 Jan 1975).

The object of ceramic processing is to form ware having certain shapes and properties. Thus, one test of the success of processing procedures must be in terms of the resulting structure and characteristics of a material after firing. During the firing process some few variations resulting from processing may be evened out, but the great majority of variation tends to be amplified. Examination of a few cases illustrates the nature of the defect amplification process. (auth)

20206 (GA-A-13254) PREPARATION OF SILICON NITRIDE COATINGS BY ION PLATING. Chin, J.; Elsner, N. B. (General Atomic Co., San Diego, Calif. (USA)). 9 Dec 1975. Contract AT(04-3)-943. 25p. (CONF-750234-1). Dep. NTIS $4.25.

From conference on structure-property relationship in thick film bulk coatings; San Francisco, California, USA (10 Feb 1975).

Ion plating experiments were used to deposit silicon nitride coatings on N- and P-type 85 Si-15 Mo. The presence of phosphorus in N-type 85 Si-15 Mo (which is doped beyond its solubility limit) influenced the grain size of the deposit. Mass spectrographic analyses of uncoated and coated substrates yielded phosphorus and SiO partial pressures above these substrates when they were held at 1100°C. All coatings were substoichiometric in silicon relative to Si_3N_4. Rates of evaporation for these coatings are plotted as a function of time at 1100°C and 10^{-3} torr. Sample weight loss rates were highest in uncoated controls and lowest in Si_3N_4-coated P-type 85 Si-15 Mo. (auth)

20207 (INIS-mf-1761, pp 20-29) MAGNETIC AND STRUCTURAL PROPERTIES OF $BiFeO_3$. Blaauw, C.; Woude, F. van der. 4 Oct 1974.

In investigation of some systems exhibiting electrical conduction anomalies. (Rijksuniversiteit Groningen (Netherlands)).

The ferroelectric and antiferromagnetic orthoferrite $BiFeO_3$ was studied using the Moessbauer effect. (INIS)

20208 (INIS-mf-1761, pp 30-40) MOESSBAUER STUDY AND BAND STRUCTURE OF $FeSi_2$. Blaauw, C.; Woude, F. van der; Sawatzky, G. A. 4 Oct 1974.

In investigation of some systems exhibiting electrical conduction anomalies. (Rijksuniversiteit Groningen (Netherlands)).

A study of the Moessbauer effect as a function of temperature was carried out for the two crystallographic phases of $FeSi_2$.

The spectra show a quadrupole splitting for all Fe positions which slightly decreases with increasing temperature. The isomer shift values are characteristic for covalent Fe compounds. For each structure a band model is proposed, explaining the differences in electrical and magnetic properties. (auth)

20209 (INIS-mf-1761, pp 101-119) THE METAL-NON METAL TRANSITION IN VO_2: X-RAY PHOTOEMISSION AND RESISTIVITY EXPERIMENTS. Blaauw, C. 4 Oct 1974.

In investigation of some systems exhibiting electrical conduction anomalies. (Rijksuniversiteit Groningen (Netherlands)).

The temperature dependence of the band gap in semiconducting VO_2 was determined by means of XPS measurements. The results are in good agreement with the results obtained in resistivity measurements. The energy gap is temperature dependent with a room temperature value of 0.3 eV. The vanadium 3d bandwidth increases above the transition temperature. The core lines, which are asymmetric below T_t, broaden and become symmetric above T_t. These changes in line shape and line width are due to the difference in the response of the valence electrons in the metal to a sudden perturbation as made in an XPS experiment. They are discussed in terms of the theory of Doniach and Sunjic. A model is discussed to explain the symmetrical broadening in the metallic region, which requires that the core hole-valence electron interaction is comparable to the bandwidth. The relative shift in the O-1s and V-2p peak positions below and above T_t indicates a transfer of charge from the V^{4+} to the O^{2-} ion in the semiconducting region, suggesting a more covalent bond than in the metallic phase. (auth)

20210 (LA-2429) PROCESSING AND TESTING OF Mo-UO_2 FUEL ELEMENTS. Lenz, W. H.; Peterson, C. E.; Taub, J. M. (Los Alamos Scientific Lab., N. Mex. (USA)). 5 Dec 1960. Contract W-7405-ENG-36. 178p. Dep. NTIS $12.00.

Declassified 28 Aug 1973.

The production of Mo-20 vol% UO_2 sheet and foil for high-temperature fuel elements in a nuclear propulsion reactor was investigated. Numerous powder types were prepared, and the effects of powder variables were traced through subsequent processing operations. Extensive experimentation was devoted to the powder-rolling process and to the hot-rolling of powder-rolled strip. Foil 1.5 in. wide and sheet 5 in. wide were produced by this process. The formation of fuel elements directly by pressing and sintering was attempted, resulting in a process for obtaining high density pieces without rolling or coining. UO_2 losses at temperatures in the 1900-2600°C range were measured to evaluate the suitability of the various materials. (auth)

20211 (SAND-75-0346) MECHANICAL PROPERTIES OF MOLYBDENUM-SEALING GLASS-CERAMICS. Swearengen, J. C.; Eagan, R. J. (Sandia Labs., Albuquerque, N. Mex. (USA)). Jul 1975. Contract AT(29-1)-789. 36p. Dep. NTIS $5.00.

Elastic constants, thermal expansion, strength, and fracture toughness were determined for a molybdenum-sealing glass-ceramic containing approximately 31 volume percent Zn_2SiO_4 crystals in a glass matrix. The microstructure was studied for two different crystallization treatments and moderate changes in composition. Mechanical properties of the composite were compared with the properties of the constituent phases through application of mixture theory and by fractographic observations. The reinforcing effects of the crystal phase at room temperature are evident in comparison with the properties of the residual glass but not necessarily in comparison with the parent glass. Fracture toughness of the composite depends primarily upon additive properties of the separate phases instead of by interactive effects such as microcracks. (auth)

20212 (SLA-74-0157) COMPATIBILITY OF DIELECTRIC AND HEAT SHIELD MATERIAL COMBINATIONS DURING ABLATIONS. Mead, K. E.; Sheldahl, R. E.; Wright, G. F. (Sandia Labs., Albuquerque, N. Mex. (USA); Sandia Labs., Livermore, Calif. (USA)). Jul 1975. Contract AT(29-1)-789. 41p. Dep. NTIS $5.25.

The surface recession and mass-transfer rates of materials suitable for reentry thermal protection of microwave antennas have been examined. Experiments were performed with subsonic-turbulent flow of air in a confined channel. In supporting experiments, selected material combinations were subjected to ablative splash tests in the Sandia High Enthalpy Arc Tunnel. Microwave window materials were tested adjacent to ablative heat shield materials in combinations and configurations under consideration for reentry vehicle applications. Test results indicated that fused silica was compatible with quartz-phenolic and carbon-phenolic heat shield materials while the ablative characteristics of hot-pressed boron nitride were very similar to those of the STC-7 carbon composite developed by Sandia Laboratories. (auth)

20213 (UCRL-51857) AN EXPERIMENTAL STUDY OF LiH STOICHIOMETRY AT ELEVATED TEMPERATURES AND PRESSURES. Piwinskii, A. J.; Lilley, E. M.; Smith, G. S. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 25 Jun 1975. Contract W-7405-Eng-48. 16p. Dep. NTIS $4.00.

The stoichiometry of LiH was studied at 500 to 900°K at hydrogen pressures between 2.5 and 6.0 GPa. Results and interpretation are complicated by the presence of ubiquitous intermetallic compounds from encapsulating materials, which are formed at pressures below 4.0 GPa. The most definitive results were produced in an assembly that consisted of a Ag-Pd inner capsule and tantalum outer capsule at a pressure of 5.0 GPa and 733°K. This run produced no change in LiH stoichiometry, nor any change in the NaCl-type crystal structure. It is concluded that up to a pressure of 6.0 GPa and a temperature of 803°K, no quenchable LiH/sub n/ with n greater than 1 can be produced. (auth)

20214 GALLIUM ARSENIDE AND RELATED COMPOUNDS, 1974. Fifth International Symposium Held in Deauville, France, September 24-26, 1974. Conference Series Number 24. New York; American Institute of Physics (1975). 386p. (CONF-7409112-). $45.00.

From fifth international symposium on gallium arsenide and related compounds; Deauville, France (24 Sep 1974).

Topics discussed at the conference include material analysis, crystal growth by liquid phase epitaxy and molecular beam epitaxy, microwave devices, optoelectronic devices, light emitting diodes, and device processing. (JRD)

20215 PARTIAL AND INTEGRAL THERMODYNAMIC PROPERTIES OF NONSTOICHIOMETRIC VANADIUM SESQUIOXIDE. Vasil'eva, I. A.; Sukhushina, I. S. (Moscow State Univ.). J. Chem. Thermodyn.; 7: No. 1, 5-12(Jan 1975).

The partial thermodynamic functions of vanadium oxides, $VO_{1.5}$ to $VO_{1.5+y}$, and integral thermodynamic functions for reactions of the type $VO_{1.5} + (x/2)O_2 = VO_{1.5+x}$, where x varies from 0 to y, were determined over the temperature range 1173 to 1373°K by emf measurements on a solid-electrolyte cell of the type Pt, $VO_{1.5+x}$ | 0.85 $ZrO_2 \cdot 0.15$ CaO | Ni, NiO, Pt. The relation between the upper boundary of the homogeneity range for vanadium sesquioxide and the temperature was derived in the temperature range 800 to 1700°K. The dependence of $\Delta H(O_2)$ and $\Delta S(O_2)$ on the composition over the homogeneity range was estimated. (auth)

20216 LITHIUM NITRIDE (Li_3N): STANDARD ENTHALPY OF FORMATION BY SOLUTION CALORIMETRY. O'Hare, P. A. G.; Johnson, G. K. (Argonne National Lab., Ill.). J. Chem. Thermodyn.; 7: No. 1, 13-20(Jan 1975).

The enthalpies of reaction of a carefully prepared and characterized specimen of lithium nitride, Li_3N, with H_2O and with HCl(aq) were found to be $-(581.62 \pm 1.42)$ kJ mol^{-1} [$-(139.01 \pm 0.34)$ kcal mol^{-1}] and $-(803.50 \pm 1.26)$ kJ mol^{-1} [$-(192.04 \pm 0.30)$ kcal mol^{-1}], respectively. Enthalpies of solution of LiCl and NH_4Cl were also measured. Combination of the measured results with auxiliary thermochemical data from the literature yielded values of $-(165.14 \pm 1.55)$ kJ mol^{-1} [$-(39.47 \pm 0.37)$ kcal mol^{-1}] and $-(164.77 \pm 1.51)$ kJ mol^{-1} [$-(39.38 \pm 0.36)$ kcal mol^{-1}] respectively, for the standard enthalpy of formation, ΔH_f° (Li_3N, c, 298.15°K). A weighted mean value, $-(164.93 \pm 1.09)$ kJ mol^{-1} [$-(39.42 \pm 0.26)$ kcal mol^{-1}], is recommended for ΔH_f° (Li_3N, c, 298.15°K). This result differs by about 8 kcal mol^{-1} from previous determinations. (auth)

20217 THERMAL STABILITY OF SILICON CARBIDE FIBRES. Lindley, M. W.; Jones, B. F. (Admiralty Materials Lab., Poole, Eng.). Nature (London).; 255: No. 5508, 474-475(5 Jun 1975).

It is pointed out that the potential of high-strength SiC fibres for use in composite materials depends on their thermal stability, and particularly on their ability to retain their strength after exposure to composite fabrication temperatures and subsequent service conditions. A marked reduction in strength has been reported after exposure of the fibres to high temperatures, although this has not been observed with single crystal or bulk polycrystalline SiC. A study is reported here on the effect of high temperatures on the tensile fracture strengths of pyrolytically deposited SiC fibres from several sources. The strengths after exposure were found to be considerably higher than expected from previously published data. The fibres examined all had less than theoretical densities and had β SiC structures with varying amounts of a disordered SiC phase: they were heated in air or Ar at various temperatures above 1000°C. Fracture strengths were measured at room temperature in tension. Because the fibres shattered on failure when they were tested in air the tests were performed in an organic liquid that was sufficiently viscous to prevent shattering but had no significant effect on the fibre fracture strengths. Tungsten and carbon substrates were employed. The influence of void formation and surface and substrate flaws was investigated. It was concluded that good strength retention could be achieved if surface attack could be avoided, and that the potential of the fibres as a high temperature reinforce-

ment in metal or ceramic composites is considerably greater than was thought. (UK)

20218 ENTHALPY OF FORMATION OF HAFNIUM DIOXIDE. Kornilov, A. N.; Ushakova, I. M.; Huber, E. J.; Holley, C. E. Jr. (Moscow State Univ.). J. Chem. Thermodyn.; 7: No. 1, 21-26 (Jan 1975).

From 28th annual calorimetry conference; Worcester, MA (12 Jun 1973).

A discrepancy in the literature was resolved and the standard enthalpy of formation of hafnium dioxide, HfO_2, was determined by oxygen-bomb combustion calorimetry to be H_f^0 (HfO_2 monoclinic, 298.15°K) = $-(267.12 \pm 0.39)$ kcal mol^{-1}. (auth)

20219 LUMINESCENCE OF MgO UNDOPED OR DOPED WITH Cr OR Fe ATOMS UNDER 500-keV PROTON IRRADIATION. Seiyama, T.; Hiraoka, E. Annu. Rep. Radiat. Center Osaka Prefect.; 15: 41-47(1974).

The emission intensities of the 348- and 375-nm bands of the crystals of MgO doped intentionally with considerable amounts of impurity chromium or iron atoms were observed to increase upon 500-keV proton irradiation. The growth of the centers responsible for the zero-phonon lines at 361 and 413 nm upon the proton irradiation was observed on the sample with an appreciable amount of impurity chromium atoms. (auth)

20220 INVESTIGATION OF THE THERMAL CONDUCTIVITY OF BORIC OXIDE. Lezhenin, F. F.; Korneychuk, A. A.; Berzhatii, B. I.; Gritsayenko, V. P. (Engineering Thermophysics Inst., Kiev). Heat Transfer—Sov. Res.; 7: No. 2, 159-161(1975).

Translated from Teplofiz. Teplotekh.; 25: 94-96(1973).

The thermal conductivity of B_2O_3 was determined in the following mixtures: 95% B_2O_3 + 5% Na_2O, 90% B_2O_3 + 10% Na_2O, 95% B_2O_3 + 5% K_2O_3, 90% B_2O_3 + 10% K_2O_3, and 97% B_2O_3 + 3% PbO. The results are reduced to the form of a temperature function. (auth)

20221 CRYSTAL STRUCTURE OF VANADIUM SUBOXIDE V_2O_{14x}. Hiraga, K.; Hirabayashi, M. (Tohoku Univ., Sendai). J. Solid State Chem.; 14: No. 3, 219-228(Jul 1975).

A monoclinic structure with the unit cell content $2V_7O_3$ and its derivative structure designated as V_7O_{3+x} were determined by x-ray and electron diffraction study. In both structures, the oxygen atoms occupy regularly special octahedral interstitial sites in the body-centered monoclinic (or pseudo-tetragonal) metal lattice with the axial ratio $c/a \approx 1.2$. The ordered distribution of the oxygen atoms is interpreted from the condition of minimization of the elastic strain in the vanadium lattice. (9 fig) (auth)

20222 CRYSTAL STRUCTURES OF THE FLUORITE-RELATED INTERMEDIATE RARE-EARTH OXIDES. Kunzmann, P.; Eyring, L. (Arizona State Univ., Tempe). J. Solid State Chem.; 14: No. 3, 229-237(Jul 1975).

The binary oxides of the rare-earth elements are, except for the A- and B-type sesquioxides, members of a fluorite-related homologous series R_nO_{2n-1} ($n = 4, 6, 7, 9, 10, 11, 12, \infty$ are well established and a related phase with $n = 10\frac{1}{2}$ has been reported). In this paper an electron optical study of members of the series is discussed which reveals the unit cell dimensions and possible space groups of the intermediate phases as well as the transformation matrices in terms of the fluorite substructure. This information reveals the structural relationships among the members of the series as well as the highest common structural feature involved. Structures are proposed for members of this series consistent with the new results obtained and with the data already in existence. (auth)

20223 PREPARATION AND PROPERTIES OF REACTIVELY CO-SPUTTERED TRANSPARENT CONDUCTING FILMS. Lehmann, H. W.; Widmer, R. (Labs. RCA Ltd., Zurich). Thin Solid Films; 27: No. 2, 359-368(Jun 1975).

The method of reactive co-sputtering was used to determine the optimum dopant concentration for low resistivity In_2O_3/SnO_2 and SnO_2/Sb_2O_5 films. The optimum concentration of SnO_2 in In_2O_3 was approximately 10 mol. % and of Sb_2O_5 in SnO_2 about 7 mol. %. The resistivity increased sharply at lower dopant concentrations but changed only slightly at higher dopant concentrations. The lowest resistivity for reactively sputtered highly transparent In_2O_3/SnO_2 films was 1.5×10^{-3} Ω cm and for SnO_2/Sb_2O_5 films 3×10^{-3} Ω cm. Reactively sputtered In_2O_3/SnO_2 films show a strong (111) texture and have an extremely smooth surface. (auth)

20224 PRESSURE SINTERING: RECENT ADVANCES IN MECHANISMS AND TECHNOLOGY. Spriggs, R. M.; Dutta, S. K. (Lehigh Univ., Bethlehem, PA). Sci. Sintering; 6: No. ½, 1-23 (May 1974).

Recent advances in an understanding of the mechanisms pressure sintering are outlined. These include not only recent diffusion models but also the combined concurrent effects of particle rearrangement, plastic flow, and diffusion. Also described are multicomponent mechanisms, either containing or enhancing Newtonian diffusional mechanisms. By analogy with results of recent steady-state creep studies, the possible role of diffusion-controlled grain-boundary sliding is also suggested. Significant technological advances have also been made recently and these are described. Included are the achievement of microstructural uniformity and the development of a number of non-oxide ceramics for high performance applications (e.g., Si_3N_4, SiC, B_4O, B_4C, SiB_6, CaB_6, and Be_4B_5). Areas for future study are suggested where lack of basic information limits the understanding of pressure sintering. (auth)

20225 CHARGE-TRANSFER OF TETRAVALENT LANTHANIDE IONS IN OXIDES. Hoefdraad, H. (Rijksuniversiteit, Utrecht). pp 5-24 of Charge-Transfer Spectra of Lanthanide Ions in Oxides. Hoefdraad, H. (ed.). Utrecht; Rijksuniversiteit (12 Mar 1975).

Reflection spectra were studied of tetravalent Pr and Tb oxides in solid solution in Sr_2ZrO_4, Ba_2ZrO_4, $SrZrO_3$, $BaZrO_3$, $BaCeO_3$, $BaHfO_3$, and $BaThO_3$; and of CeO_2 in Sr_2ZrO_4, Ba_2ZrO_4, $BaZrO_3$, and $BaThO_3$ in concentrations up to 1 at.%, all diluted in MgO. All these compounds have the tetravalent metal ion surrounded by six O-atoms in octahedral coordination. With Pr and Tb, two absorption shoulders were found at 400 and 336 nm which did not vary with temperature from 300 to 130°K. Tb in $BaZrO_3$ and in Ba_2ZrO_4 showed an additional shoulder at 455 nm with some temperature dependence. The Ce solid solutions showed only one absorption band at 312 nm. Next the tetravalent oxides were studied in solid solution in $ZrSiO_4$, $ZrGeO_4$, $ThGeO_4$ and ThO_2, in which they are surrounded by eight O-atoms in cubical coordination. With Ce again, one band was found at about 320 nm and with Pr and Tb bands which varied somewhat with the host. It is argued that this variation is inherent in the cubical coordination itself. (NL)

20226 ELLIPSOMETRY OF ANODIC OXIDE FILMS ON TUNGSTEN. Sarakinos, J.; Spyridelis, J. (Aristotle Univ. of Thessalonik, Greece). Thin Solid Films; 27: No. 2, 239-245 (Jun 1975).

Non-porous anodic oxide films on tungsten, formed in sulfuric acid and at very low current density (1 mA cm^{-2}), have been examined using ellipsometry and electron microscopy. Ellipsometry measurements, in conjunction with a suitable computing program, show that the anodic film consists of two layers with slightly different refractive indices, i.e., $n_1 = 2.207$ and $n_2 = 2.322$, while the ratio $G = d_1/(d_1 + d_2)$ (with d the thickness) of the two layers is 0.509. The rate of growth of the total film thickness as a function of cell voltage at constant current density is constant and equal to 18.4 Å V^{-1}. Electron microscopy observations confirm these results. (auth)

20227 ELECTRICAL PROPERTIES OF VACUUM-DEPOSITED FILMS OF TUNGSTEN OXIDE. Kant, K. P. (Univ. of Allahabad, India); Srivastava, R. Thin Solid Films; 28: No. 1, L13-L16(Jul 1975).

Electrical conduction at 25, 90, and 190°C was investigated for two Al/WO_3/Al sandwiches with WO_3 thicknesses of 1380 and 3090 Å. Irreversible breakdown occurs at 5.5×10^6 V/cm. Log I vs $V^{\frac{1}{2}}$ curves are straight lines at fields below 10^5 V/cm, and the slopes are compared with Schottky and Poole—Frenkel theories. Log I vs $\frac{1}{F}$ curves (F = field) at high fields are almost straight lines, suggesting tunneling. (DLC)

20228 INFLUENCE OF STACKING FAULTS ON THE GROWTH OF POLYTYPE STRUCTURES. Pandey, D.; Krishna, P. (Banaras Hindu Univ., India). Philos. Mag.; 31: No. 5, 1133-1148(May 1975).

A faulted matrix model of polytypism has been applied to the deduction of SiC polytypes. It is shown that all the SiC polytypes so far regarded as "anomalous" can result from an appropriate screw dislocation ledge exposed in a 6H, 15R or 4H matrix. The probable fault configurations in each of these parent structures have been determined from a calculation of stacking fault energy. The most frequently occurring structure series in SiC are those which have the lowest stacking fault energy. Thus, there is an excellent agreement between the polytype structures expected on the basis of the faulted matrix model and those actually observed. The limitation of the Zhdanov numbers to 2, 3, and 4 in a polytype structure is explained. It is possible to predict the more probable structures for a polytype on the basis of the above model. (auth)

20229 DETERMINATION OF MELTING POINTS OF METAL NITRIDES UNDER NITROGEN PRESSURE. Ettmayer, P.; Kieffer, R.; Hattinger, F. (Technische Hochschule, Vienna (Austria). Inst. fuer Chemische Technologie Anorganischer Stoffe). Metall; 28: No. 12, 1151-1156(Dec 1974). (In German).

5 figs.; 11 tabs.; 19 refs.

The melting points of the mononitrides of the metals Ti, Zr, Hf, and V were redetermined under nitrogen pressures up to 80 at. A melting point of 2,350 ± 20°C could be obtained for VN, which is 300°C up on that reported as jet. NbN and TaN cannot be brought to the melt undecomposed even at a nitrogen pressure of 80 at. The obtained melting points of 2,630 ± 20°C (Nb_2N) and 2,930 ± 30°C (Ta_2N), respectively, thus represent the melting temperatures of the subnitrides Nb_2N and Ta_2N, respectively, and not those of the mononitrides. YN melts undecomposed at 2,670 ± 40°C. (GE)

20230 INVERSE ISOTOPE EFFECT IN PdH AND PdD. Brown, J. S. (Univ. of Vermont, Burlington). Phys. Lett.; 51A: No. 2, 99-100(10 Feb 1975).

Calculations of the superconducting transition temperature ratio of PdH and PdD are presented, using a recent model introduced by Hertel, but allowing the first neighbor force constants to differ somewhat in these two substances, as predicted from the thermodynamic measurements by Sicking. The central result is to show that the calculated transition temperature difference is in good agreement with experimental results, contrary to the conclusion of Hertel, who set the PdH and PdD force constants equal. (auth)

20231 IMPROVEMENTS IN OR RELATING TO SILICON CARBIDE ARTEFACTS. Kennedy, P.; Scott, K. T. (to United Kingdom Atomic Energy Authority). British Patent 1,382,987/B/. 5 Feb 1975. Filed date 10 Nov 1971. 2p.

A method is described for providing a hole in a siliconized carbide artifact. The method comprises including in a green SiC artifact a former or plug containing graphite of density at least 0.963 g/cc, following the required geometrical shape, siliconizing the artifact, and removing the graphite. By selecting graphite of density at least 0.963 g/cc, permeation by Si during the siliconizing process is resisted and an impermeable layer of SiC is formed on the surface of the graphite during the early stages of the process. The graphite may be removed after siliconizing by drilling or burning out. The green SiC artifact is normally formed by blending SiC and C with a binder that is removed before siliconizing. Where a C lining to the hole in the finished artifact is acceptable or desirable the shape formed in the green artifact may be oversized. It is then only necessary to drill out the graphite to make a hole of the required size after firing and it is possible in this way to make holes of complicated shape. An example is given of application of the process to form a spinneret. (UK)

20232 INTERACTION OF A HIGH-ENERGY ELECTRON BEAM WITH THIN FILMS OF CERMET AND MLT-3M ALLOY. Vyatskii, A. Ya.; Kabanov, A. N.; Smirnov, B. N.; Trunev, V. V. Radio Eng. Electron. Phys. (USSR) (Engl. Transl.); 19: No. 6, 139-141(1974).

Translated from Radiotekh. Elektron.; 19: No. 6, 1326-1329 (Jun 1974).

Integral characteristics of the primary interaction processes of high-energy electron beams with substances of practical importance in microelectronics and elionic processing methods were investigated. The transmission, reflection and absorption of high-energy electron beams with an initial energy of E_0 = 10–35 keV and a current density of 1 to 3 A/cm^2 were investigated simultaneously in thin films of cermet (50% SiO + 50% Cr) and MLT-3M alloy. The measurements were made under pulsed conditions with a pulse length τ = 5–300 μs and a repetition frequency f = 0 to 1000 Hz, at a beam current density of 1 to 3 A/cm^2. It was found that the transmission, reflection, and absorption of electrons in SiO_2–Cr cermet and MLT-3M used in elionic technology and microelectronics obey the same general rules as metals, semiconductors, and insulators. (auth)

20233 ZIRCONIUM NITRIDE; NOW USED AS A TECHNICAL MATERIAL. Kirner, K. (Bosch (R.) G.m.b.H., Stuttgart (F. R. Germany). Abt. fuer Werkstoffkunde). Ber. Dtsch. Keram. Ges.; 52: No. 4, 77-79(Apr 1975). (In German).

From annual meeting of the Deutsche Keramische Gesellschaft; Wiesbaden, F. R. Germany (30 Sep 1974). 4 figs.; 1 tab.; 2 refs. Also issued as AED-Conf-74-451-001.

A survey of the physical and technological properties of high-melting nitrides is followed by a discussion of a plasma spraying of nitride powders, particularly of ZrN. Nitrogen is to be used both as the plasma gas and for transporting the powder. At high plasma temperatures ZrN loses N_2 and combines with O_2 from the atmosphere so that the resulting layer becomes an oxynitride: $ZrN_{1-x}O_x$. This grey substance can be re-nitrided to give the original yellow ZrN. Recently ZrN has found a large-scale industrial application, e.g., for electrodes in the production of spark-plug connectors with booster gap in the Bosch factories. (GE)

20234 INFRARED SPECTRUM OF $LaGaO_3$. Baran, E. J. (La Plata Univ. Nacional (Argentina). Facultad de Ciencias Exactas). Z. Naturforsch., B; 30: No. 1, 136-137(Feb 1975). (In German).

1 fig.; 13 refs.

The ir spectrum of $LaGaO_3$ is reported and discussed in comparison with those of related compounds. The valence force constant for the Ga-O bonds is also estimated. (GE)

20235 X-RAY EMISSION SPECTRA AND ELECTRONIC STRUCTURE OF VO, VN, VC. Gubanov, V. A.; Kasimov, B. G.; Kurmaev, E. Z. (Inst. of Chemistry, Moscow). J. Phys. Chem. Solids; 36: No. 9, 861-869(Sep 1975).

The experimental K_β and L_α emission spectra for vanadium and K_α spectra for nonmetal are studied for vanadium monoxide, nitride, and carbide. Using the spectra unfolding, the experimental molecular orbital diagrams have been obtained. By the semi-empirical Mulliken-Wolfsberg-Helmholz method with the self-consistency on charges and configurations the calculations of electronic structure of clusters $[VO_6]^{10-}$, $[VN_6]^{15-}$ and $[VC_6]^{20-}$ have been carried out. The results of calculations are compared with the x-ray data. The effects of chemical bonding and charge densities on metal atoms in VO, VN, VC are discussed. (auth)

20236 NIOBIUM--HYDROGEN SYSTEM: A STUDY OF THE alpha YIELDS alpha + beta PHASE CHANGE BY CHANNELING OF 1 MeV He IONS. Whitton, J. L. (Chalk River Nuclear Labs., Ont.); Mitchell, J. B.; Schober, T.; Wenzl, H. Scr. Metall.; 9: No. 8, 851-854(Aug 1975).

The backscattered yield of light ions in Nb is sensitive to the lattice distortion caused by H precipitation in the form of Nb hydride. Thus, the transition temperature T/sub c/ for the phase change alpha yields alpha + beta can be determined. T/sub c/ is plotted vs H/Nb ratio. It is shown that this method is more sensitive and accurate than other methods, such as resistance, internal friction, etc. (DLC)

20237 COMPREHENSIVE DEFORMATION OF POLYCRYSTALLINE UO_2. Radford, K. C.; Terwilliger, G. R. (Westinghouse Research Labs., Pittsburgh). J. Am. Ceram. Soc.; 58: No. 7-8, 274-278(1975).

The deformation of polycrystalline stoichiometric UO_2 in compression exhibits a low-temperature (less than 1200°C) behavior that is distinct from its high-temperature behavior. The data for both temperature regions fit either an Arrhenius equation, gamma equals nu exp [–DELTA H/sub (tau)//RT], or the relation gamma equals A tau/sup n//T exp [–DELTA H_0/RT]. At low temperatures, the activation energy and volume, the shape of the yield-stress-temperature curve, and the grain size-strength relation suggest a Peierls mechanism as rate-controlling in the deformation process. At high temperatures (greater than or equal to 1300°C), a different dislocation mechanism becomes rate-controlling for coarse-grained material, whereas very fine-grained (1 mu m) material exhibits Nabarro–Herring deformation. (auth)

20238 YTTRIA–HAFNIA SYSTEM. Stacy, D. W.; Wilder, D. R. (Iowa State Univ., Ames). J. Am. Ceram. Soc.; 58: No. 7-8, 285-288(1975).

Phase equilibria in the yttria-hafnia system were investigated by high-temperature and room-temperature x-ray diffraction. The HfO_2 transformation, solid solution limits, and liquidus temperatures are given. A tentative phase diagram is proposed. (auth)

20239 COMPRESSIVE STRENGTH OF BORON SUBOXIDE. Ruh, R.; Atkins, G. R.; Petrak, D. R. (Wright-Patterson AFB, OH). J. Am. Ceram. Soc.; 58: No. 7-8, 357(1975).

From 77th annual meeting of the American Ceramic Society; Washington, DC (5 May 1975).

The room temperature compressive strength of B_6O was investigated as a function of porosity. Data are included showing that the ratio of compressive strength to flexural strength is 4.8:1. (JRD)

20240 FORMATION OF SOLID SOLUTIONS BY ISOMORPHIC CARBIDES, NITRIDES, OXIDES, AND BORIDES OF TRANSITION METALS OF GROUPS IV AND V. Gusev, A. I.; Shveikin, G. P. (Ural Scientific Center, USSR). Inorg. Mater.; 10: No. 12, 1840-1843(Jun 1975).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 12, 2144-2147(Dec 1974).

Formation of unrestricted solid solutions by metallic compounds of the interstitial-phase type is examined. The relative difference in their electron densities is proposed as a criterion of the mutual solubility of the components of the systems. In pseudobinary systems formed by monocarbides, mononitrides, monozides, and monoborides of transition metals of groups IV and V, continuous series of solid solutions are formed when the relative difference between the electron densities of the components is not more than 32.5 to 33.0%. Suggestions are made concerning the character of the reaction in 92 uninvestigated nitride, oxide, boride, oxycarbide,

oxynitride, oxyboride, borocarbide, and boronitride systems. (auth)

20241 THE SYSTEM Y–Co–B. Kuz'ma, Yu. B.; Stepanchikova, G. F. Inorg. Mater.; 10: No. 12, 1905-1906(Jun 1975).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 12, 2223-2225(Dec 1974).

The phase equilibriums in this system were investigated along with the crystal structures of compounds found in the various phases. With a low rare-earth content (up to 20 at.%), the systems Y–Co–B and Ce–Co–B resemble one another in the character of the phase equilibria and in the formation of a series of isostructural compounds RCo_3B_3, RCo_4B, $R_2Co_{11}B_4$, $R_2Co_7B_3$ and RCo_4B_4, where R is Y or Ce. With an increase in the rare-earth content in the systems R–Co–B, the mutual similarity is no longer displayed; a similar pattern observed in the case of the binary systems Ce–Co and Y–Co. A particular feature of the system Y–Co–B is the formation of the compound YCo_2B_2 with a structure of the $CeAl_2Ga_2$ type. The boron atoms in the structure of this compound have a coordination number of 9 (8 + 1) and a coordination polyhedron in the form of a tetragonal antiprism with the additional boron atom opposite one of the faces of the square. The coupling of the boron atoms leads to formation a B_2 pair. The compound YCo_2B_2 is the first representative of the structural type $CeAl_2Ga_2$ among borides. (auth)

20242 STRUCTURAL CHEMICAL STUDIES ON THE STABILITY RANGE OF THE $ThCr_2Si_2$-TYPE. Excerpt. May, N. Darmstadt, Ger.; Univ. Darmstadt (1974). 4p. (In German). INIS.

Thesis.

In the course of an experimental study of the bond in intermetallic alloys of the Zintl phase type, ternary alloys containing one transition element and one element of the 4th main group in addition to the alkaline earth metals were analyzed. Most of the alloys were also structurally analyzed. (GE)

20243 HIGH-TEMPERATURE REGION OF STABLE EXISTENCE OF ZIRCONIUM MONONITRIDE. Erop'yan, M. A.; Avarbe, R. G. Inorg. Mater.; 10: No. 12, 1850-1852(Jun 1975).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 12, 2156-2159(Dec 1974).

A method is described for high-temperature research on equilibrium in the system Zr–N and investigate equilibrium in this system within the region of homogeneity of the mononitride phase at 2480 to 3670°K in the range of nitrogen pressures from 10^{-3} to 60 atm. The dependence of the lattice constant of oxygen-free zirconium nitride on the nitrogen content is determined. (auth)

20244 DENSITIES OF LOW-COMPONENT GLASSES IRRADIATED WITH GAMMA-NEUTRON FLUXES. Keshishyan, T. N.; Piterskikh, S. E.; Fainberg, E. A. (Moscow Chemicotechnological Inst.). Inorg. Mater.; 10: No. 12, 1890-1893(Jun 1975).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 12, 2205-2209(Dec 1974).

Binary and ternary glasses in the systems $NaO_{0.5}$–$KO_{0.5}$–SiO_2, and $NaO_{0.5}$–PbO–SiO_2 were studied. A regular density variation as a function of oxide ratio was found. A model of density variation based on the structures of individual glasses is suggested. (JRD)

20245 X-RAY INVESTIGATION OF A PHOTOPYROCERAMIC IRRADIATED WITH FAST NEUTRONS. Berezhnoi, A. I.; Krasnikov, A. S.; Ivanova, V. I.; Krasnikova, M. D. (Ryazan State Pedagogic Inst., USSR). Inorg. Mater.; 10: No. 12, 1923-1924(Jun 1975).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; No. 12, 2242-2243(Dec 1974).

Specimens of lithium aluminosilicate photopyroceramic were irradiated with 10-MeV neutrons. Darkening of the original yellow color of this compound under irradiation was associated with silver reduction. It was also found that irradiation induces increased point defects and microstresses thus changing the physicochemical properties. (JRD)

20246 FORMATION OF CUBIC MOLYBDENUM CARBIDE BY THE CARBONIZATION OF MoO_3 WITH PLASMA ARC AND PROPERTIES OF THE PRODUCTS. Matsumoto, O.; Saito, M.; Yoshino, T. (Aoyama Gakuin Univ., Tokyo (Japan). Coll. of Science and Engineering). Bull. Chem. Soc. Jap.; 47: No. 9, 2226-2228(Sep 1974).

The formation of cubic molybdenum carbide (α-MoC_{1-x}) by the carbonization of MoO_3 with graphite by heating with argon plasma arc was studied. α-MoC_{1-x} including a small amount of hexagonal η-MoC_{1-x} was formed. By the carbonization of a mixture of MoO_3 and TiO_2 with graphite, a cubic solid solution of Mo–Ti–C system was formed. Chemical and x-ray analyses showed that the cubic form is defective in carbon content. The density of the cubic form was in agreement with that determined by means of x-ray diffraction. The products were found to be superconductors, the transition temperature varying with composition. The highest transition temperature 11.7 K was obtained for $Mo_{0.95}TiO_{0.05}C_{0.75}$. (auth)

20247 EFFECT OF REACTOR IRRADIATION ON THE PHYSICAL PROPERTIES OF FUSED QUARTZ. Suzuki, H.; Iseki, T. (Tokyo Inst. of Tech. (Japan)); Yamamoto, A. Bull. Tokyo Inst. Technol. (Engl. Ed.); No. 121, 83-88(Mar 1974).

Effects of a very small amount of impurity on the radiation-induced change of the properties of fused quartz, viz. density, optical transmittance, elastic constant, bending strength and thermal conductivity were investigated. Two kinds of fused quartz were used: normal grade fused quartz prepared by fusing Brazilian quartz and synthetic fused quartz produced from highly pure $SiCl_4$. The amount of impurities in the synthetic fused quartz was less than that of normal grade by about a factor of ten. Irradiation was carried out in the hole VT-1 of JRR-2. Specimens were sleeved in graphite and sealed in aluminum capsules in air. The specimens were heated by gamma-heating, and the graphite sleeve was thermally insulated from reactor coolant with the air gap between the graphite sleeve and the aluminum capsule. The irradiation temperature of specimens was from 430 to 520°C. Fast neutron flux was 2.4×10^{19} and 5.0×10^{19} n/cm^2. The experiment revealed that impurity concentration had little influence on the results except optical transmittance spectra. Further irradiation such as 10^{21} n/cm^2 is necessary to clarify the effect of impurity on the property change of fused quartz. (JA)

20248 NEUTRON DIFFRACTION OF $ThC_{0.76}$ AT ROOM TEMPERATURE. Ogawa, T. (Tohoku Univ., Sendai (Japan). Faculty of Engineering); Matsumoto, M.; Honma, T. Kakuriken Kenkyu Hokoku; 7: No. 1, 91-93(Jun 1974). (In Japanese).

Thorium carbide of NaCl-type fcc structure has wide uncertain composition band, for example the ratio C/Th being 0.70 ~ 1.00 at room temperature. If superlattice exists, the structure must have only carbon atoms (or 25% void of carbon) from the fact that there is no change in the face centered cubic lattice of thorium around the composition of Th $C_{0.75}$. Neutron diffraction of the powdered sample of Th $C_{0.76}$ was carried out. The amplitudes of neutron scattering is $b_n = 1.01 \times 10^{-12}$ cm for thorium and $b_n = 0.661 \times 10^{-12}$ cm for carbon. Results showed the nonexistence of the extra lines reported by Loranzelli et al and the extra lines derived from the Cu_3Au type lattice assumed by Prof. Sato. The R factor was about 9.1% which was calculated from the eq. $(\Sigma I_{obs} - I_{cal})/\Sigma I_{obs}$. The existence of superlattice was not confirmed in this work. The work is being continued according to a new plan. (JA)

20249 GAMMA-IRRADIATION EFFECT AND TRACE ELEMENTS OF NATURAL QUARTZ CRYSTALS. Konno, H. (Tohoku Univ., Sendai (Japan). Faculty of Science). Ganseki Kobutsu Kosho Gakkaishi; 69: No. 9, 324-331(Sep 1974). (In Japanese).

Quartz crystals of various geologic origins have been irradiated by ^{60}Co γ-rays to elucidate the relation between absorption coefficients and the contents of trace elements, especially of Al, Li, and K. The absorption maxima perpendicular to the optic axis are at 480 nm for natural smoky quartz, 460 nm for artificially colored smoky quartz. A clear correlation was noticed between absorption coefficients ($\alpha_1 - \alpha_1$) and Al/Li ratio, suggesting that the coloring of smoky quartz is due to Al–Li defects. It was also noticed that K ion plays a negative role in the coloring. As a general tendency, it was noticed that quartz crystals formed under higher temperature conditions, such as those from pegmatites are more readily colored than those from epithermal veins. (JA)

20250 MULTIPLE SCATTERING OF X-RAYS AND NEUTRONS. I. A Recurrence Formula for the Taylor Series Expansion in the Calculation of Intensities. Parente, C. B. R.; Caticha-Ellis, S. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Jap. J. Appl. Phys.; 13: No. 10, 1501-1505(Oct 1974).

Experimental and theoretical work on the multiple scattering of x rays and neutrons with emphasis on their application to the study of crystal defects, which is a rather new use of a known phenomenon is discussed. The exact intensity solution for a crystal plate is too complicated when more than 3 beams are simultaneously diffracted by the crystal. Taylor series expansion limited to the first three orders were calculated, but the errors due to the approximation were not assessed and the use of higher order terms involves exceedingly complicated expressions. A general recurrence formula for the successive terms of the Taylor series is presented. Thus, a rapid calculation of any number of terms is now possible. (auth)

20251 FUNDAMENTAL STUDY ON ISOLATION AND DETERMINATION OF CARBIDES IN STEEL. Narita, K.; Hara, H.; Miyamoto, A.; Iwakiri, H. (Kobe Steel Ltd. (Japan). Central Research and Development Lab.). Tetsu to Hagane; 60: No. 13, 1962-1979(Nov 1974). (In Japanese).

Some mineral acid separation and potentiostatic electrolysis method for isolation and determination of various carbides in steels were fundamentally investigated. Globular and coarse Fe_3C and other various carbides such as TiC, ZrC, VC, NbC, $(Cr,Fe)_7C_3$, $(Cr,Fe)_{23}C_6$, Mo_2C and $(Fe,W)_6C$ were extracted quantitatively by means of potentiostatic electrolysis method with 15% sodium citrate-1·2% KBr-30% citric acid or acetyl aceton-1% tetramethyl ammonium chloride-methanol electrolyte. The reproducible separation of TiC, VC and NbC with HCl (1 + 1) and $(Cr,Fe)_7C_3$, $(Cr,Fe)_{23}C_6$ and Mo_2C with H_3PO_4(2 + 1) could be successfully accomplished if these carbides were relatively coarse. TiC, ZrC, and VC, considered insoluble in mineral acids, were found to be attacked gradually by diluted HCl, H_2SO_4 and H_3PO_4 and were easily dissolved as the particles of the carbide were fine. (auth)

20252 STUDY ON PHASE ANALYSIS OF BORON IN STEEL. Kawamura, K.; Otsubo, T.; Furukawa, T. (Nippon Steel Corp., Tokyo). Tetsu To Hagane; 60: No. 13, 1944-1956(Nov 1974). (In Japanese).

An attempt was made to establish a method for phase analysis of boron in steels, which contributes to the investigation of hardenability. Extraction of boron compounds from steel was confirmed to be favorably carried out by either the I_2-CH_3OH (14%) method or the electrolytic method. Fine particles of boron compounds are apt to be dissolved by H_2SO_4 (1 + 6) at 60°C and a part of them passes through the filter paper containing a little amount of filter pulp. The strong phosphoric acid decomposition of sample is most suitable for determination of total boron in steel. The effective boron is calculated by subtraction of the I_2-CH_3OH insoluble boron fraction from the total boron amount determined by the strong phosphoric acid method. The effect of boron on hardenability of steel corresponds evidently with the effective boron content. The investigation on boron distribution by means of the α-track technique suggested the relation between concentration of boron on pre-austenitic grain boundaries and the effective boron content. (auth)

20253 ON THE ANODIC BEHAVIORS OF GRAPHITE IN MOLTEN POTASSIUM FLUOROBORATE-BORON TRIOXIDE MIXTURE. Huang, J. C.; Akashi, K. (Tokyo Univ. (Japan). Inst. of Industrial Science). Denki Kagaku; 42: No. 10, 501-507 (Oct 1974).

Most work on the electrolytic production of boron has dealt with cathodic phenomena, and therefore the mechanism of anodic reaction is not well known. The anodic reaction of graphite electrodes in $KBF_4-B_2O_3$ melt in consideration of the direct analogy to the melt of $Na_3AlF_6-Al_2O_3$ in aluminum production. The critical current density (CCD) of the boron system is a linear function of the concentration of B_2O_3. The diffusion coefficients of oxygen-concentration anions are 2.24×10^{-4} cm^2/sec (0.5 – 1.5 Wt % B_2O_3) and 3.54×10^{-6} cm^2/sec (3.5 – 8.0 wt % B_2O_3), as determined by chronopotentiometry. A small amount of CF_4 is detected with CO and CO_2 in the evolved gas before the anode effect (AE) by a chromatograph having an activated carbon column, and CF_4 increases rapidly after the AE. A fact that free fluorine is not detected in the evolved gas before and after the AE, suggests the strong bonding between graphite and fluorine. (auth)

20254 EFFECT OF THERMAL NEUTRON IRRADIATIONS ON SUPERCONDUCTIVITY OF B-1 COMPOUNDS DOPED WITH ^{10}B AND ^{235}U. Bauer, H. (Univ. of Giessen, Ger.); Saur, E. J.; Schweitzer, D. G. J. Low Temp. Phys.; 19: No. 3-4, 189-200 (May 1974).

The effect of lattice damage caused by products of ^{10}B(n,alpha) ^{7}Li reactions and ^{235}U fissions at room temperature on the properties of bulk NbN and Nb(C,N) wires has been investigated. For both types of compounds the critical currents in transverse magnetic fields at 4.2 K show a sharp peak near H/sub c2/ which is increased by irradiation, whereas at low fields the critical currents are enhanced for Nb(C,N) but reduced for NbN. The upper critical field and the lattice parameter are slightly increased but no change in the transition temperature by irradiation was observed. The critical current behavior of Nb(C,N) samples was found to agree qualitatively with a flux pinning model developed by Kramer. (auth)

20255 NEW INSTRUMENTS FOR THERMOPHYSICAL INVESTIGATIONS. Novitskii, L. A.; Ergardt, N. N. High Temp.; 12: No. 4, 803-805(1974).

Translated from Teplofiz. Vys. Temp.; 12: No. 4, 913-915 (1974).

Investigations were made of the temperature dependences (1300 to 2200°K) of the work function, the microhardness, the coefficient of thermal expansion, the specific electrical resistance, and the Hall constant of the binary boride systems TiB_2-ZrB_2, TiB_2-NbB_2, and $TiB_2-Mo_2B_5$. Results are presented in tables and plots. It is noted that the use of mutual alloys based on diborides as emitters makes it possible, over broad limits, to regulate the value of the density of the saturation current by a change in the molar composition of the compounds, while the improvement in the mechanical properties and the increase in the electrical resistance make it possible to use them as cathodes in straight-through channels. Extrapolation of the temperature dependence of the work function to a temperature of 2500°K yields a value of $\varphi \approx 4$ eV, which can ensure take-off of a current density up to 10 A/cm^2. The physical properties of binary boride systems are such that they can be used as high-temperature cathode materials for special units in the new technology. (auth)

20256 METALLURGY OF THORIATED TUNGSTEN POWDERS AND THE DEVELOPMENT OF IONIZERS. Hivert, A. (ONERA, Chatillon, France). Acta Electron.; 17: No. 4, 415-420(Oct 1974). (In French).

The solution proposed for solving the problem presented by the porous tungsten wall used in the ionization of cesium by contacts consists essentially of hampering the tungsten recrystallization mechanism by introducing a dispersed thoria phase and of developing nonmachined walls by incorporating a sublimable plastic paste, which permits the calendering and stamping of thin sheets in the appropriate matrix. This process permitted the production of pieces of various shapes including flat wafers, or curved pellets, flat or curved strips with rectangular or rounded extremities. The porosity, which is determined by the proportion of the plastic paste, can vary between 25 and 40%. The pores, 1 to 3 microns in dimension, number 20 to 30 million by cm^2. The results appear favorable concerning the neutral rate, the permeability and the aging effects. (auth)

20257 NEW ETCH FOR LIQUID METAL FAST BREEDER REACTOR MATERIALS. Bender, J. H.; Baker, C.; Johnson, K. A. (Los Alamos Scientific Lab., NM) pp 187-195 of Microstructural Science. Volume 2. Fritzke, G. P. (ed.). New York; American Elsevier Publishing Company, Inc. (1974).

From sixth meeting of International Metallographic Society of America; Los Angeles, California, USA (25 Sep 1973). See CONF-730973-.

Etchants for irradiated uranium plutonium mixed oxide experimental fast breeder reactor fuels have been various combinations of H_2O, HNO_3, HF, $CeNO_3$, H_2O_2 and H_2SO_4. These etches have not been entirely satisfactory in delineating the grain structure and grain boundaries of irradiated (U, Pu)O_2. In addition these usual oxide etches destructively attack some areas of the irradiated (U,Pu)O_2 fuel. Irradiated oxide fuel usually contains a number of types of microstructures and a variety of compositions because of thermal and fission product gradients. A hydrobromic acid etch composed of (10ml HCL, 10ml HBr, 1ml HF), when applied to irradiated (U, Pu)O_2 fuel does not destroy any of the structures present, but the etch does clearly delineate all fuel regions. Removal of the hydrobromic etch for electron microprobe examination or as-polished reviewing of the sample is accomplished by lightly polishing the sample surface and does not necessitate extensive repolishing procedures. When the hydrobromic etch is applied to irradiated stainless steel and Incoloy 800 cladding the carburized regions, reaction zones and the recoil region are more clearly delineated than with previously used chemical or electrolytic etches and again without the detrimental effects of water and electrolysis on the accompanying fuel specimen. (auth)

Metals and Alloys

Refer also to abstracts 20194 and 20257.

20258 (KAPL-M-7412) EXCESS ENTROPY FOR A VACANCY IN A CRYSTAL. Brudnoy, D. M. (Knolls Atomic Power Lab., Schenectady, N. Y. (USA)). Apr. 1975. 46p. Dep. NTIS $5.50.

The excess entropy for a single vacancy in any crystal with cyclic boundary conditions is given, within the small perturbation approximation, by DELTAS/k/sub B/ equals d/2, independent of crystal structure and particle interaction, dependent only on the dimensionality of the crystal, d. It is argued that the effect of free surface boundary conditions on DELTAS, within an exact theory, for any localized defect (not only a vacancy), is negligible. Using the vacancy perturbation result for DELTAS and Lawson's formula, a value for the vacancy formation volume is obtained only in terms of known measured parameters. If localized vibrational modes are present due to the vacancy, what effect these might have on DELTAS, and, from this, what materials might be candidates for observing these localized modes are discussed. (auth)

20259 (RDT-M-2-12T(7-75)) NICKEL–MOLYBDENUM–CHROMIUM ALLOY WELDING FITTINGS (ASME SA-403 WITH ADDITIONAL REQUIREMEMENTS). (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). Jul 1975. 8p. RSO.

This standard covers Ni–Mo–Cr alloy welding fittings for nuclear and associated applications. The additional requirements cover material, manufacture, heat treatment, testing, examination, etc. Optional provisions are also included. (DLC)

20260 (RDT-M-3-1T(7-75)) CARBON STEEL SEAMLESS PIPE (ASME SA-106 WITH ADDITIONAL REQUIREMENTS). (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). Jul 1975. 8p. RSO.

This standard covers carbon steel seamless pipe for nuclear and associated applications. It concludes: basis of purchase, additional requirements (heat treatment, repair, testing, etc.), supplements, and optional provisions. (DLC)

20261 (RDT-M-3-5T(7-75)) AUSTENITIC STAINLESS STEEL WELDED TUBING (ASME SA-249 WITH ADDITIONAL REQUIREMENTS). Fuller, R. M. (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). Jul 1975. 8p. RSO.

This standard covers austenitic stainless steel welded tubing for nuclear and associated applications. The additional requirements cover: heat treatment, analysis, testing, etc. Application supplements and optional provisions are also included. (DLC)

20262 (RDT-M-3-10T(7-75)) NICKEL–MOLYBDENUM–CHROMIUM ALLOY SEAMLESS PIPE AND TUBES (ASME SB-167 WITH ADDITIONAL REQUIREMENTS). Fuller, R. M. (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). Jul 1975. 8p. RSO.

This standard covers Ni–Mo–Cr alloy seamless pipe and tubes for nuclear and associated applications. Additional requirements (analysis, testing, examination, etc.) and optional provisions are included. (DLC)

20263 (RDT-M-3-29T(7-75)) NICKEL–CHROMIUM–MOLYBDENUM–COLUMBIUM ALLOY SEAMLESS TUBES (AMS 5589 WITH ADDITIONAL REQUIREMENTS). Fuller, R. M. (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). Jul 1975. 8p. RSO.

This standard covers Ni–Cr–Mo–Nb alloy tubes for nuclear and associated applications. Basis of purchase, additional requirements (analysis, testing, etc.), application supplements, and optional provisions are included. (DLC)

20264 (RDT-M-3-32T(7-75)) SEAMLESS MEDIUM CARBON STEEL BOILER AND SUPERHEATER TUBES (ASME SA-210 WITH ADDITIONAL REQUIREMENTS). Fuller, R. M. (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). Jul 1975. 8p. RSO.

This standard covers seamless medium carbon steel boiler and superheater tubes for nuclear and associated applications. Additional requirements, application supplements, and optional provisions are included. (DLC)

20265 THERMOMAGNETIC METHOD OF DETERMINING THE CHEMICAL COMPOSITION OF THE BINDER PHASE IN TUNGSTEN-SINTERED CARBIDES AND ITS USE. Tumanov, V. I.; Shchetilina, E. A.; Cheredinov, A. A.; Serebrova, O. I.; Korchakova, E. A.; Elizarov, V. N.; Elmanova, S. M. (All-Union Scientific-Research Inst. for Hard Alloys, Moscow). Sov. J. Nondestr. Test.; 10: No. 6, 641-646(1974).

Translated from Defektoskopiya; 10: No. 6, 24-30(1974).

In WC–Co two-phase industrial tungsten-sintered carbides, the tungsten content in the binder phase may vary from 2 to 20% as a result of variations in the carbon content, with substantial effects on the strength and wear resistance of the carbide. A method of determining the chemical composition of the binder phase is presented on the basis of the alloy's Curie point. Use is made of a thermomagnetic method (change in the magnetic permeability in relation to temperature), the change in the Curie point of cobalt base solid solutions in relation to composition is determined, and a calibration curve for determining the tungsten content in the Co phase of the carbides is drawn. The UTK automated device for recording thermomagnetic curves was developed and the binder-phase composition in production carbides was investigated. The relationship between the composition of the Co phase and the mechanical properties (strength, wear resistance) of VK8, VK15, and VK50 carbides is shown. (auth)

Corrosion and Erosion

Refer also to abstracts 19256, 20226, and 21499.

20266 (ARH-1290) STRESS CORROSION CRACKING OF A515 GRADE 60 CARBON STEEL. Moore, E. L. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). 27 Jul 1971. 12p. Dep. NTIS $4.00.

An investigation was conducted to evaluate the effect of welding method plate thickness, and subsequent stress relief treatment on the stress corrosion cracking propensity of ASTM A515 Grade 60 carbon steel plate exposed to a 5 M $NaNO_3$ solution at 190°F for eight weeks. It was found that all weld coupons receiving no thermal stress relief treatment cracked within eight weeks; all weld coupons given a vibratory stress relief cracked within eight weeks; two of the eight weld coupons stress relieved at 600°F for one hour cracked within eight weeks; none of the weld coupons stress relieved at 1100°F for one hour cracked within eight weeks; and that cracking was generally more severe in coupons fabricated from $\frac{7}{8}$ inch plate by shielded metal arc welding than it was in coupons fabricated by other welding methods. (auth)

20267 (RD/B/N-3355) CORROSION OF STEELS IN MOLTEN SODIUM HYDROXIDE. Part 1. The Experimental Approach and Preliminary Presentation of Results for the Corrosion of $2\frac{1}{4}$–1 Mo by Static Sodium Hydroxide. Newman, R. N.; Smith, C. A.; Smith, R. J. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Mar 1975. 15p. Dep. NTIS (US Sales Only) $4.00.

The role of sodium hydroxide corrosion is discussed in relation to the wastage of materials observed in the vicinity of a water leak into sodium. An experimental technique to study the corrosion under varying conditions is described. The results presented are confined to those for $2\frac{1}{4}$Cr–1Mo obtained in static sodium hydroxide in a closed volume over the temperature range 760 to 1000°C. It is found that the corrosion rate can be followed by monitoring the hydrogen produced by the reaction. After an initial acceleration period the rate law is parabolic. The numerical values of rates obtained in these preliminary experiments relate to the conditions described. (auth)

20268 (SAND-75-0103) LOW VOLTAGE INITIATION OF DAMAGING ARCS BETWEEN ELECTRICAL CONTACTS. Cuthrell, R. E. (Sandia Labs., Albuquerque, N. Mex. (USA); Sandia Labs., Livermore, Calif. (USA)). Jul 1975. Contract AT(29-1)-789. 27p. Dep. NTIS $4.50.

Metallic arcs were found to precede the firm contacting of electrical contacts which were closed without bounce. When the open-circuit voltages were below the ionization potential, the initiation of these arcs was found to depend on the presence of asperities on the surfaces and on asperity contracting, melting, and pinching off by magnetic forces. The arc is thought to be initiated inductively when the molten metallic asperity contact is pinched off, and the electrode damage is similar to that produced by the arcing of opening contacts. Arcing could not be produced for exceptionally smooth surfaces, or, for rough surfaces when the open-circuit potential was below the melting voltages of the electrode metals. In order to prevent damage to contact surfaces by melting or arcing, it is suggested that test potentials be limited to below the melting voltages, that the current be limited, the test circuits be designed to prevent inductively generated high voltage transients, and the contact surfaces be very smooth. In order to facilitate arc initiation in arc welding applications, it is suggested that the surfaces of electrodes and work pieces be roughened. (auth)

20269 (SAND-75-0191) STRESS CORROSION CRACKING IN QUENCHED AND UNDERAGED U-6 wt. PERCENT Nb. Magnani, N. J. (Sandia Labs., Albuquerque, N. Mex. (USA); Sandia Labs., Livermore, Calif. (USA)). Jul 1975. Contract AT(29-1)-789. 20p. Dep. NTIS $4.00.

Two types of stress corrosion cracking occur in U–6 wt percent Nb. Intergranular (anodic dissolution) cracking occurs in aqueous Cl^- environments. Transgranular (oxide stress rupture) cracking occurs in gaseous environments containing oxygen. Aging the quenched alloy at 200°C for 2 hours increases the yield strength but only slightly lowers the stress corrosion cracking threshold. (auth)

20270 SOLUBILITY OF OXYGEN IN LIQUID SODIUM AND ITS CORROSION EFFECT. Ilincev, G. (Staatliches Forschungsinstitut fuer Materialschutz, Prague). Kernenergie; 18: No. 3, 69-75(1975). (In German).

A vacuum distilling apparatus provided for determining oxygen content in sodium and optimization of the distillation are described. Construction of the apparatus makes determination of the oxygen content in liquid sodium with comparatively high accuracy possible. A minimum amount of about 1 to 1.5 ppM O_2 can be determined when a nickel crucible is used for distillation. The temperature dependence of oxygen equilibrium solubility in liquid sodium has been determined in a relatively wide interval of cold trap temperature (100 up to 400°C). The corrosion of structural materials is shown to be directly proportional to oxygen activity in the liquid sodium. From the viewpoint of corrosion of most of the structural

materials used in fast reactors, an oxygen concentration of less than 5 ppM in liquid sodium is considered optimal, a concentration up to 10 ppM undesired, and a concentration of more than 10 ppM dangerous in most cases. (auth)

20271 CHEMISORPTION OF HYDROGEN AND NITROGEN ON THE Mo(100) SURFACE. Huang, C. H. Providence, RI; Brown Univ. (1974). 234p. University Microfilms Order No. 75-9179.

Thesis (Ph.D.).

The chemisorption of nitrogen and hydrogen on the Mo(100) surface was studied at temperatures ranging from room temperature down to below −100°C by means of Auger electron spectroscopy (AES), flash desorption mass spectrometry, work function measurement, and low energy electron diffraction (LEED). Hydrogen is found to adsorb dissociatively on the Mo(100) surface and shows 3 distinct chemisorbed states, namely, β_1, β_2, and β_3, which can be distinguished by the associated changes of the LEED pattern, by their sticking probability, work function, and the intensities of the Mo Auger peaks and plasmon peaks. The adsorption of nitrogen on the Mo(100) surface shows one low-temperature molecular γ state and 2 high-temperature atomic states, namely, β_1 and β_2. (auth)

20272 PROBLEMS OF HYDROGEN EMBRITTLEMENT WITH SPECIAL CONSIDERATION OF GALVANOTECHNICAL PROCESSES. Paatsch, W. pp 97-101 of Das verhalten mechanisch beanspruchter werkstoffe und bauteile unter korrosionseinwirkung. Duesseldorf; Verein Deutscher Ingenieure (1975). (In German).

From VDI-meeting: The behaviour of mechanically stressed materials and components under corrosion; Lindau, F. R. Germany (17 Apr 1975).

The mechanism of hydrogen embrittlement and the resulting damage to the material are discussed in this paper, and some measures to prevent embrittlement are proposed. (GE)

20273 FIELD EMISSION AND TRANSMISSION ELECTRON MICROSCOPY OF CARBURIZATION OF TUNGSTEN SINGLE CRYSTALS. Okuyama, F. (Nagoya Inst. of Tech, Japan). Philos. Mag.; 31: No. 5, 1201-1208(May 1975).

The carburization of tungsten single crystals through chemical reaction with gaseous acetone at pressure 10^{-5} to 10^{-4} torr and at temperature 1500 to 1800°K was studied by means of a field emission and a transmission electron microscope. A single-crystal field emitter tip of tungsten is wholly converted into a W_2C single crystal after a full carburization: a single-crystal overlayer of W_2C initially forms at the tip surface, increasing in thickness until the entire tip is carburized into a W_2C single crystal. The carburization takes place in a definite crystallographic orientation and is accompanied by a slight volume expansion and a remarkable change in the tip geometry. (auth)

20274 EFFECT OF PLATING CONDITIONS ON PERFORMANCE OF POROUS CADMIUM DEPOSIT. Altura, D. (Lazaar Research Labs.; Los Angeles); Mansfeld, F. Corrosion; 31: No. 6, 214-218(Jun 1975).

Porous cadmium plating of high-strength steel was evaluated in terms of corrosion behavior, hydrogen embrittlement of the steel due to plating, and the relationship of these parameters to the microstructure of the electrodeposit. Emphasis was placed on investigating this system under conditions which can be encountered in industrial plating. High plating current density and low cadmium concentration of the plating bath result in severe hydrogen embrittlement. The rate of cadmium dissolution, when Cd plated steel was galvanically coupled to Al 2024, is found to increase linearly with increasing plating current density and is also affected by variation of the cadmium concentration of the plating bath. Additions of Na_2CO_3 tend to decrease cadmium dissolution rate, while $FeSO_4$ additions have no apparent effect on either corrosion behavior of the Cd coating or hydrogen embrittlement of the steel. Scanning electron photomicrographs indicate that the plate structure is crystalline, containing numerous microscopic pores, some of which penetrate to the surface of the steel substrate. These pores are thought to facilitate the escape (during subsequent baking) of hydrogen trapped within the plate. (auth)

20275 OXIDATION BEHAVIOR OF AN ALIGNED Co-TaC EUTECTIC ALLOY. Smeggil, J. G. (General Electric Co., Schenectady, NY). Oxid. Met.; 9: No. 3, 225-257(Jun 1975).

The oxidation behavior of the directionally aligned eutectic alloy, TaC-Co50B, a Co-based TaC alloy, was examined between 600 and 1155°C. Parabolic oxidation behavior, isotropic in nature, is found to 800°C. Above 800°C, the oxidation behavior is no longer either parabolic or isotropic. The interaction between the Co matrix alloy and the TaC fibers adjacent to the oxidizing interface is reported as a function of temperature in oxidation. (The composition is 50.5 percent Co, 15 percent Cr, 8.5 percent Ni, 6 percent W, 18.67 percent Ta, 1.33 wt percent C.) (auth)

20276 HIGH-TEMPERATURE OXIDATION OF Ni-20 PERCENT Cr ALLOYS CONTAINING VARIOUS OXIDE DISPERSIONS. Wright, I. G.; Wilcox, B. A.; Jaffee, R. I. (Battelle, Columbus Labs., OH). Oxid. Met.; 9: No. 3, 275-305(Jun 1975).

The oxidation behavior of Ni-20 percent Cr alloys containing approximately 3 vol. percent Y_2O_3, ThO_2, and Al_2O_3 as dispersed particles was examined in the temperature range 900 to 1200°C in slowly flowing oxygen at 100 torr. Results show that the oxidation behavior of the Y_2O_3-, ThO_2-, Al_2O_3-, and CeO_2-containing alloys is very similar and that some anomalies in the behavior of the ThO_2-containing alloy might be explained by the slower rate of chromium diffusion in this coarse-grained alloy. Two Al_2O_3-containing alloys were studied. One with a relatively coarse dispersoid size behaved in a manner analogous to a dispersion-free Ni-30 percent Cr alloy at 1100°C. The other alloy contained a dispersion of fine Al_2O_3 particles and behaved exactly like the Y_2O_3-containing alloy at 1000 and 1100°C, but at 1200°C oxidized at a faster rate. It is shown that the adherent scales on dispersion-containing alloys have a stabilized fine grain size, whereas the nonadherent scales on dispersion-free alloys undergo grain growth. (auth)

20277 USE OF A VARIABLE RECTANGULAR CURRENT FOR STUDYING THE MECHANISM OF NIOBIUM OXIDATION. Trifonov, V. V.; Malygin, V. V.; Kondrashin, V. Yu.; Shatalov, A. Ya. (Voronezh State Univ., USSR). Izv. Vyssh. Ucheb. Zaved., 18: No. 4, 670-671(1975). (In Russian).

A diagram is presented and the principle of operation is described for a simple electronic transformer of sinusoidal waves to rectangular pulses of adjustable length and polarity. An oscillogram of the potential of a niobium−niobium oxide electrode polarized by a variable rectangular current indicates significant reversibility of the electrochemical oxidation-reduction processes. The average anode current density (i_A) operating directly on the oxidation process was calculated. With a polarization current density of 100 mA/cm² (50 Hz), i_A = 5 mA/cm². (tr-auth)

20278 FORMATION OF THE PHOSPHATES OF TRIVALENT AND TETRAVALENT VANADIUM IN FUSED PHOSPHORIC ACIDS. Lavrov, A. V.; Guzeeva, L. S.; Fedorov, P. M. Inorg. Mater.; 10: No. 12, 1869-1871(Jun 1975).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 12, 2180-2183(Dec 1974).

The reactions of V_2O_3, $VOCl_2$, and metallic vanadium with fused phosphoric acids at 110 to 480°C were investigated. The phosphates of trivalent vanadium, $VH_2P_3O_{10}$ and $V(PO_3)_3$, and one of tetravalent vanadium, $VO(PO_3)_2$ were separated and characterized. The thermal stabilities of these compounds were determined and processes of self-reduction of V(IV) and stabilization of V(III) in phosphate systems were established. (auth)

20279 SOLUBILITY OF HYDROGEN IN MOLYBDENUM AND ITS ALLOYS. Eguchi, T.; Morozumi, S. (Tohoku Univ., Sendai (Japan)). J. Jap. Inst. Metals; 38: No. 11, 1019-1025(Nov 1974). (In Japanese).

Solubility of hydrogen in molybdenum and its binary solid solution alloys containing titanium, zirconium, vanadium, and niobium, respectively, was measured in the temperature range between 600 and 1200°C under one atmosphere pressure of hydrogen gas. Relative partial molar entropy $\Delta \bar{S}^{xs}$ and enthalpy $\Delta \bar{H}$ for hydrogen solubility in molybdenum were obtained as $\Delta \bar{S}^{xs} = -15.8$ cal/g-atom · deg and $\Delta \bar{H} = 9.51$ kcal/g-atom respectively. The solubility increased with increase in the amount of each alloying element. The entropy of the alloys first decreased with increase in the alloying elements and became almost constant with a value of approximately −17.5 cal/g-atom · deg. Vibrational frequency of hydrogen atom calculated from $\Delta \bar{S}^{xs}$ values was 3.0×10^{13} sec^{-1} for molybdenum and 4.0×10^{13} sec^{-1} for the alloys. In Mo−Ti alloys, and Mo−V and Mo−Nb alloys containing more than about 10 at. % of each alloying element, the enthalpy decreased monotonically with increase in electron/atom ratio. Values of $\Delta \bar{S}^{xs}$ and Δ H in Mo−V and Mo−Nb alloys were minimum at the composition of about 3 at. % of these alloying elements. Variation of these values seemed to be related to the electronic specific heat coefficient of alloys. In Mo−Zr alloys, the lattice strain induced by alloying also affected the solubility. (auth)

20280 CORROSION AND ELECTROCHEMICAL BEHAVIOR OF CERTAIN ALLOYS OF URANIUM WITH ZIRCONIUM, NIOBIUM, AND MOLYBDENUM IN AQUEOUS SOLUTIONS. Gomozov, L. I.; Kishinevii, V. B.; Ivanov, O. S.; Byalobzhenskii, A. V.; Lukinskaya, V. N. Sov. At. Energy (Engl. Transl.); 37: No. 5, 1182-1185(Nov 1974).

Translated from At. Energ. (USSR); 37: No. 5, 423-425(Nov. 1974).

The alloys were tested in aqueous solutions of sodium sulfate or sulfuric acid at 90 and 100°C. Results of potentiostatic and corrosion investigations demonstrated the advisability of the

alloying of uranium with zirconium, niobium, and molybdenum for increasing its corrosion resistance in aqueous solutions at 100°C. Damage to the original (formed in air) oxide film on uranium as a result of the breakdown of uranium carbides in water was detected. It was shown that in the case of uranium and the U–Nb–Mo alloy deaeration of a solution of 0.1 N H_2SO_4 by replacement of the air atmosphere by argon does not influence the shape of the potentiodynamic curves. For the remaining alloys, an atmosphere of air shifts the polarization curve on the region of active dissolution into a more positive region of potentials, which is evidence of the passivating role of oxygen for these alloys. (auth)

Preparation and Fabrication

Refer also to abstracts 19401 and 20256.

20281 (CONF-740570-P4, pp vp Paper 9) RECRYSTALLIZATION AND CREEP OF TUNGSTEN WIRES IN NICKEL–TUNGSTEN COMPOSITES. Fischmeister, H. F.; Kannappan, A. (Chalmers Univ. of Tech., Goteborg). 1974.

From 8th plansee seminar: heat-resisting and wear-resisting sintered materials; Reutte, Austria (27 May 1974).

In 8th plansee seminar: papers and discussions. IV.

A technique for producing W–Ni composites by powder forging is described. This method produces no detrimental interaction between the W fibers and the matrix. Long exposure to high temperatures, however, provokes recrystallization of the tungsten—even when alloyed with Re or ThO_2—and loss of strength. At the same time, the creep strength of the wires is drastically reduced. The creep data obtained are consistent with Coble creep enhanced by the presence of nickel in the tungsten grain boundaries. (auth)

20282 (CONF-740570-P4, pp vp Paper 17) POWDER METALLURGY OF PURE TITANIUM AND Ti–6Al–4V ALLOY. Mueller, C. P.; Raymont, W. R.; Humphrey, J. R. 1974.

From 8th plansee seminar: heat-resisting and wear-resisting sintered materials; Reutte, Austria (27 May 1974).

In 8th plansee seminar: papers and discussions. IV.

Features of the powder metallurgy processes developed for pure Ti and Ti–6Al–4V are described. Mechanical properties, reliability, and some of the components produced are discussed. (DLC)

20283 (RDT-M-1-9T(7-75)) BRAZING FILLER METAL (ASME SFA-5.8 WITH ADDITIONAL INFORMATION). Fuller, R. M. (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). Jul 1975. 4p. RSO.

This standard covers brazing filler metal for nuclear and associated applications. (DLC)

20284 (RDT-M-1-15T(7-75)) NICKEL–MOLYBDENUM–CHROMIUM ALLOY BARE WELDING RODS AND ELECTRODES. Fuller, R. M. (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). Jul 1975. 6p. RSO.

This standard covers Ni–Mo–Cr alloy bare welding rods and electrodes for nuclear and associated applications. The additional requirements cover manufacture, chemical composition, testing, etc. (DLC)

20285 (RDT-M-1-19T(6-75)) NICKEL–CHROMIUM–MOLYBDENUM–COLUMBIUM BARE WELDING RODS AND ELECTRODES. Fuller, R. M. (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). Jul 1975. 6p. RSO.

This standard covers Ni–Cr–Mo–Nb bare welding rods and electrodes for applications outside the jurisdiction of ASME Boiler and Pressure Vessel Code, Section III. The additional requirements cover manufacture, chemical composition, marking, etc. (DLC)

20286 (RDT-M-1-20T) MILD STEEL ELECTRODES FOR FLUX-CORED ARC WELDING (ASME SFA-5.20 WITH ADDITIONAL REQUIREMENTS). Fuller, R. M. (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). Jul 1975. 6p. RSO.

This standard covers mild steel electrodes for gas metal-arc welding for nuclear and associated applications. (DLC)

20287 (RDT-M-2-11T(7-75)) NICKEL–MOLYBDENUM–CHROMIUM ALLOY FORGINGS (ASME SA-182 WITH ADDITIONAL REQUIREMENTS). Fuller, R. M. (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). Jul 1975. 8p. RSO.

This standard covers Ni–Mo–Cr alloy forgings for nuclear and associated applications. The additional requirements cover drawing, testing, examination, etc. (DLC)

20288 COBALT-RARE EARTH INTERMETALLIC COMPOUNDS PRODUCED BY CALCIUM HYDRIDE REDUCTION OF OXIDES. Cech, R. E. J. Met.; 26: No. 2, 32-35(Feb 1974).

Kinetics of the reduction-diffusion reactions between CaH_2 and rare earth oxides mixed with Co powder are described. Results show that the overall process yield is dependent on the stoichiometric excess of CaH_2. It is noted that the coarser particles produced by spontaneous disintegration of the reacted cake contain Ca. (JRD)

20289 ELECTRODEPOSITION OF TERNARY ALLOYS OF IRON-COBALT-CADMIUM FROM THE SULPHATE BATH. Narang, S. K.; Rama Char, T. L. (Indian Inst. of Science, Bangalore). Electrodeposition Surface Treat.; 2: No. 2, 93-107 (Jan 1974).

Ternary alloys of iron–cobalt–cadmium were electrodeposited for the first time from the sulphate bath. Detailed studies on alloy composition, cathode efficiency, and cathode potential have led to the operating conditions for obtaining satisfactory deposits containing iron 0–60, cobalt 0–60, and cadmium 7–100%. The cathode efficiency was 39 to 99% and the limiting current density 30 A/dm^2. X-ray studies indicate the presence of mixtures of the bcc and hcp phases. (11 fig) (auth)

20290 TUNGSTEN WHISKERS BY VAPOR-PHASE GROWTH. Starliper, A. G.; Kenworthy, H. (Bureau of Mines, Rolla, MO). Electrodeposition Surface Treat.; 2: No. 4, 249-262(May 1974).

Laboratory studies were made to produce whiskers of tungsten over a wide range of operating temperatures. Hydrogen reduction of WCl_6 in a vacuum furnace at temperatures from 2,700 to 3,300°C yielded a small quantity of tungsten whiskers, provided a low degree of supersaturation was maintained. Direct measurements of 3,000,000 to 4,000,000 psi were obtained for the ultimate tensile strengths of individual whiskers averaging 3 to 4 microns in diameter with average aspect ratios of 1,000. This compares with strengths of 300,000 to 400,000 psi for 13-micron-diameter commercial filaments. (11 fig) (auth)

20291 DEPENDENCE OF INTERNAL STRESSES AND CRACKING THICKNESS IN ELECTROLYTIC Ni-Mo-COATINGS ON EXPERIMENTAL CONDITIONS. Chassaing, E.; Vu Quang Kinh. (CNRS, Virty-sur-Seine, France). Electrodeposition Surface Treat.; 2: No. 1, 65-73(Nov 1973). (In French).

Under specific experimental conditions and adequate current density, crack-free Ni–Mo coatings were electrodeposited from citrate complexing baths. Effects of bath constitution, cathodic current density, and alloy chemical composition on some intrinsic parameters of the deposit were investigated. The tensile stress rises quickly with the increasing molybdenum content of the deposit whereas the critical thickness decreases under the same conditions. The nickel sulfamate bath gives higher current efficiency and larger critical thickness than the chloride or sulfate baths. Factors responsible for crack generation of Ni–Mo deposits are discussed. (23 references) (auth)

20292 ELECTRODEPOSITION FROM LIQUID AMMONIA SOLUTIONS. Brooman, E. W. (Univ. of Salford, Eng.). Electrodeposition Surface Treat.; 2. No. 1, 1-46(Nov 1973).

A review of some of the properties of liquid ammonia as a solvent for electrodeposition is given. Data from the literature on the deposition of elements from Groups IA to VIIA of the Periodic Table are collected together and discussed. Particular emphasis is given to the electrodeposition of refractory and light metals, and the anodic deposition of elements and compounds of interest to the super-and semiconducting industries. Liquid ammonia as a solvent holds promise for the anodic deposition of those elements which form polyanionic complexes, for compounds of these elements, and for the deposition of those elements such as Be and Ti which react with the solvent in aqueous solutions. (14 tables) (auth)

20293 ELEVATED TEMPERATURE WELDMENT BEHAVIOR AS RELATED TO NUCLEAR DESIGN CRITERIA. King, R. T.; Canonico, D. A.; Brinkman, C. R. (Oak Ridge National Lab., TN). Weld. J. (N. Y.); 54: No. 8, 265s-275s(Aug 1975).

Factors affecting the physical and mechanical properties of weldments are reviewed. Data are presented that show wide variability in the properties of weld metal and heat-affected zones both within a given weldment and from weldment to weldment. The weld metal or heat-affected zone may be stronger or weaker, and more or less ductile than the base metal joined. This implies that current design rules, which are presumed to have well-known safety factors based on the properties of base metals, may have other actual safety factors in welded construction, due to the differences between weld metal and base metal properties. Suggestions for obtaining further data that can subsequently be used to improve confidence in design rules or to change design rules for nuclear application are presented. (auth)

20294 PREPARATION OF ELECTROLYTIC ALLOYS OF TUNGSTEN WITH COBALT AND NICKEL, HAVING MINIMUM INTERNAL STRESSES. Zakharova, A. A.; Grigor, V. A.; Rotinyan, A. L. (Leningrad Technological Inst.). Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.; 18: No. 5, 787-788(1975). (In Russian).

The possibility of making a ternary alloy, Co–W–Ni, with internal stresses close to zero was demonstrated. The nickel content of the alloy was proportional to the concentration of its ions in solution, and the angular coefficient of the line A_1-C_1 was close to the value corresponding to the charge of the nickel ion at the limiting current. (tr-auth)

20295 WELDABILITY OF STRUCTURAL AND PRESSURE VESSEL STEELS. Volume 1. Conference Papers. Conference Held at Cambridge, England, November 16–19, 1970. Cambridge, Eng.; Welding Institute (1971). 196p. (CONF-701159-P1).

Twenty-one papers are included in Volume I on weldability, fabrication costs, steel specifications, estimating welding requirements, cracking problems, composition control, lamination and weld inclusions, steel quality control, and improved welding specifications. (JRD)

20296 WELDABILITY OF STRUCTURAL AND PRESSURE VESSEL STEELS. Volume 2. Discussions. Conference Held at Cambridge, England, November 16–19, 1970. Cambridge, Eng.; Welding Institute (1971). 92p. (CONF-701159-P2).

Discussions are presented on papers included in Volume I concerning the value of weldability, factors affecting weldability, effects of steel making processes on weldability, weldability control methods, and improved specifications for welding. (JRD)

Properties, Structure, and Phase Studies

Refer also to abstracts 19274, 19370, 19378, 19670, 20250, 20251, 21440, 21509, 21613, and 21730.

20297 (AECL-5032, p 42) MAGNETIC EXCITATIONS IN $PrAl_2$. Holden, T. M.; Svensson, E. C.; Buyers, W. J. L.; Purwins, H. G. (Chalk River Nuclear Labs., Ont.). Jan 1975.

In Physics Division progress report, October 1 to December 31, 1974. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

20298 (AERE-R-7961, pp 4-5) REGENT WORK IN ACTINIDES AT GRENOBLE. Blaise, A. (CEN, Grenoble, France). 1975.

From 4th actinides colloquium; Harwell, UK (Jun 1974).

In 4th actinides colloquium.

A summary of results in magnetic measurements, specific heat and neutron diffraction studies is given for Np, Am, Cm, and Np and Pu compounds of the type AnX, AnX_2, and AnX3. (MCG)

20299 (AERE-R-7961, pp 6-23) SPIN FLUCTUATIONS IN ACTINIDES. Jullien, R.; Coqblin, B. (Paris Univ., Orsay, France). 1975.

From 4th actinides colloquium; Harwell, UK (Jun 1974).

In 4th actinides colloquium.

A theoretical model, which describes the effects of spin-fluctuations at temperatures of order or greater than the spin-fluctuation temperature, was developed. The electrical resistivity, the nuclear spin relaxation rate, and the magnetic susceptibility were studied. The theoretical model is finally applied to strongly enhanced paramagnetic actinide systems such as pure neptunium and plutonium and many actinide compounds. (auth)

20300 (ANL-CT-75-46) THERMAL CYCLE TESTS OF DISSIMILAR METAL WELDS. Bump, T. R. (Argonne National Lab., Ill. (USA)). Jun 1975. Contract W-31-109-eng-38. 55p. AT.

Dissimilar-metal welds are used at the ends of the first test section for the Steam Generator Test Facility (SGTF). The materials involved are ferritic, nickel-based austenitic, and iron-based austenitic metals. To gain added confidence that the welds can withstand at least some initial thermal cycles, four full-scale samples (of the hot, sodium-inlet end, 1½ in. schedule 40 welds) were fabricated and cycled between ambient temperature and 1050°F in air, with a maximum cycle period of 1.5 h. Heat-up time was 30 to 35 min. The samples were subjected to dye penetrant and vacuum testing, and to radiography, both before and after cycling. In addition, destructive metallography and physical testing, including 180° bends, were performed after the cycling. Only the tensile test results indicated the integrity or ductility of the parent materials or welds suffered from either the fabrication or thermal cycling processes. Those tests showed that the room temperature yield strength, ultimate strength, and ductility of the ferritic metal (Croloy) were reduced as much as 20, 11, and 54 percent (below the advertised values for that heat), respectively, at some distance from the weld. It was concluded that the SGTF welds will be able to endure significantly more than 10 cycles between ambient temperature and 1050°F without failure. (auth)

20301 (CONF-740222-, pp 85-98) COMPARATIVE STATUS OF COLUMBIUM–TUNGSTEN COMPOSITES FOR GAS TURBINES. Klein, M. J.; Metcalfe, A. G. (International Harvester Co., San Diego, CA). 1974.

From symposium on engineering for the materials/energy challenge; Albuquerque, New Mexico, USA (28 Feb 1974).

In engineering for the materials/energy challenge. Proceedings of the 14 annual ASME symposium. (American Society of Mechanical Engineers. New Mexico Section).

Synthesis of composite materials for use in gas turbines above 2000°F constitute a challenging problem. Requirements for these materials are reviewed and current material development approaches are described. Comparison of properties and analysis of test data show that the niobium-tungsten composites are closest to application. The strengths and weaknesses of this composite are discussed and recommendations made for critical application. The optimum temperature range for this material appears to be 2000 to 2600°F. (auth)

20302 (CONF-740570-P4, pp vp Paper D14) PROPERTIES AND STRUCTURE OF SOME TUNGSTEN BASE ALLOYS. Labusca, E. (Inst. of Atomic Physics, Bucharest). 1974.

From 8th plansee seminar: heat-resisting and wear-resisting sintered materials; Reutte, Austria (27 May 1974).

In 8th plansee seminar: papers and discussions. IV.

The purpose was to produce W alloys with high densities, good mechanical properties, and fine homogeneous final structures. This was accomplished by sintering of and Co addition (0.5–1%) to W–^{1}Ni–^{1}Cu–^{1}Fe alloy. Data on the three properties (density, mechanical properties, structure) are given as functions of sintering temperature and Co additions. (DLC)

20303 (CONF-740570-P4, pp vp Paper D15) IMPROVEMENT OF THE MICROGRAPHIC REAGENT COLORING MOLYBDENUM GRAINS ACCORDING TO THEIR CRYSTAL ORIENTATION. Hasson, R. (CEN, Saclay, France). 1974.

From 8th plansee seminar: heat-resisting and wear-resisting sintered materials; Reutte, Austria (27 May 1974).

In 8th plansee seminar: papers and discussions. IV.

The $FeCl_3$–HCl reagent in alcohol gives coloured grains after an immersion time of 120 to 180 seconds. In aqueous solution, the same results are produced after 25 to 50 seconds. The colors obtained under these conditions are first order. Prolongation of the immersion time leads to higher order colors. The immersion time can be reduced by raising the temperature. The molybdenum is colored more quickly in used baths. (auth)

20304 (COO-3429-26) THERMAL, STRUCTURAL AND MAGNETIC STUDIES OF METALS AND INTERMETALLIC COMPOUNDS. Annual Report, 15 May 1974–15 May 1975. Wallace, W. E.; Rao, V. U. S. (Pittsburgh Univ., Pa. (USA). Dept. of Chemistry). 1 Jun 1975. Contract E(11-1)-3429. 59p. Dep. NTIS $6.00.

The cdd magnetic properties of Y_6(Fe/sub 1-x/Mn/sub x/)$_{23}$ ternaries were studied. Magnetic studies of Th(Co/sub 1-x/Ni/sub x/)$_5$ ternaries show strong magnetic anisotropy in $ThCo_5$ originates with the Co in the 2c sites. Efforts were made to effect a change of coupling in rare earth-transition metal systems, using alloys doped with Ca or Ag to lower electron concentration. The effect of Ca on magnetic properties is being studied. Results on Pr/sub 1-x/Ca/sub x/Al_2 indicate that ferromagnetic $PrAl_2$ becomes metamagnetic when Pr is partially replaced by Ca. Numerous ternaries of the formula RT_2X_2 (R equals a rare earth, T equals a 3d transition metal or metals and X equals Ge or Si) were prepared and studied magnetically. Magnetic properties of various Yb-Co binaries were determined. Heat capacity data on Dy_3Al_2 and DyNiCo are reported. H_2 absorption and desorption studies on the RT_2 systems (T equals Fe or Co) and on Tb_2Co_7 were made at several temperatures. From the temperature coefficient of these measurements the heats of solution were determined. These range from about 9 to 10 kcal per mole of hydrogen. Pulsed field gradient NMR equipment has been readied to determine the mobility of H in rare earth intermetallics. (JRD)

20305 (COO-3446-1) MODEL PSEUDOPOTENTIALS AND ATOMIC PROPERTIES OF SIMPLE METALS AND ALLOYS. Final Progress Report, 1 August 1975. Weloh, D. O. (Princeton Univ., N. J. (USA). Dept. of Aerospace and Mechanical Sciences). 1975. Contract AT(30-1)-4198. 22p. Dep. NTIS $4.25.

A theoretical investigation was made of impurity–vacancy binding and impurity diffusion by the mechanism of vacancy motion. Calculations were made of the impurity–vacancy binding energy and impurity migration energy in simple metals using model

pseudopotentials. Several model potentials and dielectric functions were used and the sensitivity of the results to the parameters of the models explored. (DLC)

20306 (COO-3476-11) INTERSTITIAL IMPURITY INTERACTIONS AND DISLOCATION MICRODYNAMICS IN Mo CRYSTALS. Kwok, D. N. (State Univ. of New York, Stony Brook (USA). Dept. of Materials Science). May 1975. Contract AT(11-1)-3476. 109p. Dep. NTIS $8.50.

Thesis.

The effects of interstitial impurities on the mechanical properties of molybdenum are explored by comparing results obtained for crystals of various interstitial contents controlled by ultra-high vacuum outgassing. Results show a modulus reduction for as-grown samples and for outgassed specimens at low applied stresses. As a function of plastic microstrain, the values of modulus defect for both as-grown and outgassed specimens saturate at the same value. Interstitial impurities act as pinning agents to dislocation bowing, but when all the easy dislocation loops have broken away from local interstitial pins, the modulus defect reaches a constant saturation value. Etch pitting techniques were used to correlate microstrain observations with dislocation generation and motion. It has been found that edge dislocation generation and movement are active in the microstrain region while screw dislocations are relatively inactive until the macrostrain region is reached. Dislocation velocities range from 10^{-6} to 10^{-3} cm/s and the average distance between interstitial impurity pinning points is found to be approximately 8×10^{-4} cm. (auth)

20307 (GESP-723) CREEP OF 347 STAINLESS STEEL IN HYDROGEN. Final report. (General Electric Co., Cincinnati, Ohio (USA). Nuclear Systems Programs). 15 Mar 1972. 74p. Dep. NTIS $6.75.

Results of creep tests on 347 stainless steel sheets at 1200, 1400, and 1600°F in hydrogen atmosphere at about 8 in. water pressure are presented. Most of the data are presented in summary curves of creep tests indicating the relations between stress and time and in percent creep–time curves. (JRD)

20308 (JUL-1160, pp P.2 p.1-12) LOW TEMPERATURE STRUCTURES. Schober, T. Jan 1975.

9 figs.; 20 refs.

In the niobium hydrogen system: an electron microscope study. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Festkoerperforschung).

The structure and morphology of low temperature hydride phases was investigated. Quenching of dilute alloys produced small hydride particles which emitted interstitial dislocation loops into the matrix. Irreversible dislocation "skeletons" were generated when such hydride precipitates were thermally dissolved. Three ordered solutions were observed: the β-phase above −45°C, the ζ-phase from −45 to −65°C and the ϵ-phase below −65°C. The reciprocal lattices of ζ and ϵ were determined. The ϵ-phase is identical with the hydride Nb_4D_3 found by Somenkov. ζ and ϵ are orthorhombic with the same lattice parameters as β. (auth)

20309 (LA-UR-75-934) REFLECTED RAREFACTIONS, DOUBLE REGULAR REFLECTION, AND MACH WAVES IN ALUMINUM AND BERYLLIUM. Neal, T. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-ENG-36. 21p. (CONF-750556-1). Dep. NTIS $4.25.

From fifth international conference on high pressure; Moscow, USSR (26 May 1975).

A number of shock techniques which can be used to obtain high-pressure equation-of-state information between the principal Hugoniot and the principal adiabat are illustrated. A rarefaction wave in aluminum shocked to 27.7 GPa [277 kbar] is examined with radiographic techniques and the bulk sound speed is determined. The two stage compression which occurs in a double shock may be attained by colliding two shocks and observing regular reflection. A radiographic method which uses this phenomenon to measure a three-stage compression of aluminum to a density of 4.7 Mg/m^3 and beryllium to a density of 3.1 Mg/m^3 is presented. The results of a Mach reflection experiment in aluminum are found to disagree substantially with the simple three-shock model. A modified model, consistent with observations, is discussed. In all cases the Gruneisen parameter is determined. (auth)

20310 (LA-UR-75-1258) THERMODYNAMIC PROPERTIES OF THE BINARY LAVES PHASE COMPOUNDS OF PLUTONIUM WITH THE GROUP VIIIa METALS. Campbell, G. M. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-eng-36. 10p. (CONF-750915-5). Dep. NTIS $4.00.

From 5th international conference on plutonium and other actinides; Baden-Baden, F. R. Germany (10 Sep 1975).

The thermodynamic properties of $PuFe_2$, $PuRu_2$ and $PuOs_2$ were determined using fused salt emf cells. The data indicate that there is a regular correlation between the stability of these AB_2 Laves type compounds and their unalloyed atomic radius ratio. The limited amount of data available tends to support the conclusion that other Laves compounds grouped according to their electronic bonding structure show a similar correlation. (auth)

20311 (NP-20480(P8), pp 99-100) POSITRON ANNIHILATION IN V AND Nb. Shiotani, N.; Okada, T.; Sekizawa, H. Dec 1974.

In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

20312 (NRL-Report-7888) CRACK-LENGTH DETERMINATION FOR THE COMPACT TENSION SPECIMEN USING A CRACK-OPENING-DISPLACEMENT CALIBRATION. Sullivan, A. M. (Naval Research Lab., Washington, D. C. (USA)). 24 Jun 1975. 14p. Naval Research Lab., Washington, DC.

A normalized calibration curve using clip-gage measurements of crack-opening-displacement (COD) at the crack mouth has been developed for the compact tension (CT) specimen. This procedure provides a simple, indirect determination of crack length during cyclic loading and is well adapted for automation of fatigue crack-growth-rate (FCGR) tests. The specific CT specimen configuration studied was the same as that employed in a recent interlaboratory FCGR testing program conducted by ASTM Sub-committee E24.04 on Subcritical Crack Growth. (auth)

20313 (NRL-Report-7910) FRACTURE MECHANICS AND FRACTOGRAPHIC STUDY OF FATIGUE-CRACK PROPAGATION RESISTANCE IN 17-4 PH STAINLESS STEELS. Crooker, T. W.; Hasson, D. F.; Yoder, G. R. (Naval Research Lab., Washington, D. C. (USA)). 17 Jul 1975. 18p. Dept. of the Navy, Arlington, VA.

A determination of fatigue-crack propagation resistance in heat-treated samples of 17-4 PH stainless steel was made, together with correlative microscopic observations via electron fractography. Two rolled plates of ½-in. thickness were investigated, one vacuum melted (VM) and heat treated to the H1050 condition and the other argon-oxygen melted (AOM) and heat treated to the H1050 and H1150 conditions. Crack-growth rates (da/dN) were obtained in ambient laboratory air as a function of stress-intensity factor range DELTA K using single-edge-notched (SEN) tension specimens. The effect of stress ratio R on da/dN was examined; values of R equals 0.04, 0.40, 0.67, and 0.80 were employed. Microscopic modes of crack propagation determined by electron fractography were utilized to explain differences in macroscopic crack-growth behavior. Both cleavage and microvoid coalescence can appear as modes of cyclic crack propagation in this family of steels, to the detriment of cyclic crack-growth resistance. When cleavage is present, the amount appears to be independent of DELTA K over a wide spectrum of DELTA K levels. Moreover, the incidence of cleavage (and accelerated cyclic crack propagation rates) increases significantly with ratio R. It was found that the heat treatment can be adjusted to minimize the incidence of cleavage, and that slight variation in alloy processing serves to eliminate cleavage and promote striation formation, while enhancing the fracture toughness. (auth)

20314 (ORNL-5025, p 228) HIGH-ENERGY NEUTRON SPUTTERING YIELDS FOR NIOBIUM AND GOLD. Jenkins, L. H.; Noggle, T. S.; Saltmarsh, M. J.; Smith, G.; Reed, R. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

Niobium and gold samples were subjected to neutron irradiation in order to investigate sputtering yields for neutron fluences up to 4×10^{16} neutrons/cm^2. Upper limits were placed on sputtering yields but analysis is incomplete. (1 figure) (SDF)

20315 (ORNL-5025, pp 228-229) OXYGEN DIFFUSION IN beta-ZIRCALOY. Perkins, R.; Bertrand, F.; Saltmarsh, M. J. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

The diffusivity of ^{18}O in beta-Zircaloy after diffusion anneals at 900 to 1500°C was measured absolutely using proton irradiation and scanning of the ^{18}F. An effective diffusion coefficient of approximately 10^{-6} cm^2/s is estimated. (DLC)

20316 (ORNL-TM-4992) CORRELATION AND EXTRAPOLATION OF CREEP DUCTILITY DATA FOR FOUR ELEVATED TEMPERATURE STRUCTURAL MATERIALS. Booker, M. K.; Brinkman, C. R.; Sikka, V. K. (Oak Ridge National Lab., Tenn. (USA)). Aug 1975. Contract W-7405-eng-26. 34p. Dep. NTIS $4.00.

The amount of deformation that a component can successfully endure without incurring failure-inducing damage can be a useful limit in elevated temperature design. Treatment of experimental creep ductility data by a parametric analysis technique allows the prediction of such limits. Application of such a method to data for various ductility indices for four elevated-temperature structural materials is presented, including a discussion of the results.

Materials studied include types 304 and 316 stainless steel, 2¼ Cr-1 Mo steel, and Inconel Alloy 718. (10 tables, 16 figures) (auth)

20317 (RDT-M-2-1T(7-75)) CARBON STEEL FORGINGS FOR PIPING COMPONENTS (ASME SA-105 WITH ADDITIONAL REQUIREMENTS). Fuller, R. M. (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). 29 Jul 1975. 7p. RSO.

A standard prescribing requirements for carbon steel forgings for piping components (ASME SA-105 with additional requirements) for nuclear and associated applications is presented. This standard supersedes RDT M 2-1T, dated November 1973. (JRD)

20318 (RDT-M-2-8T(7-75)) CARBON AND ALLOY STEEL FORGINGS (ASME SA-541) WITH ADDITIONAL REQUIREMENTS. Fuller, R. M. (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). 29 Jul 1975. 7p. RSO.

A standard prescribing requirements for carbon and alloy steel forgings (ASME SA-541 with additional requirements) for nuclear and associated applications is presented. This standard supersedes RDT M 2-8T, dated July 1971. (JRD)

20319 (RDT-M-3-27T(7-75)) SEAMLESS AND WELDED SMALL DIAMETER AUSTENITIC STAINLESS STEEL TUBING: ASTM A 632 WITH ADDITIONAL REQUIREMENTS. (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). Jul 1975. 10p. RSO.

A standard prescribing requirements for seamless and welded small diameter austenitic stainless steel tubing (ASTM A 632 with additional requirements) for nuclear and associated applications is presented. This standard supersedes RDT M 3-27T, dated January 1973. (JRD)

20320 (RDT-M-4-3T(7-75)) COBALT–CHROMIUM ALLOY CASTINGS. Fuller, R. M. (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). 29 Jul 1975. 7p. RSO.

A standard prescribing requirements for cobalt-chromium alloy castings for nuclear and associated applications is presented. This standard supersedes RDT M 4-3T, dated June 1972. (JRD)

20321 (SAND-74-5545) SUSCEPTIBILITY OF MICROWELDS IN HYBRID MICROCIRCUITS TO CORROSION DEGRADATION. Jellison, J. L. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 38p. (CONF-750450-1). Dep. NTIS $5.00.

From international reliability physics symposium; Las Vegas, Nevada, USA (1 Apr 1975).

20322 (SGAE-2198) ATTAINMENT OF OUTGASSING RATES BELOW 10^{-13} TORR LITERS/SEC CM^2 FOR ALUMINIUM AND STAINLESS STEEL AFTER BAKEOUT AT MODERATE TEMPERATURES. Moraw, G.; Dobrozemsky, R. (Oesterreichische Studiengesellschaft fuer Atomenergie G. m. b. H., Vienna). Nov 1973. 11p. (PH-153/73). INIS.

Outgassing rates after bakout were measured for stainless steel and Al by means of the throughput-method. Sample preparation before experiments: workshop machining, rinsing in acetone, and 20 hr vacuum bakeout at 150°C (to remove initial contaminations). Prior to each experiment the samples were filled with air (greater than 96 percent relative humidity). After a 20 hr vacuum bakeout at 100°C the outgassing rates are 4×10^{-14} torr l/sec cm^2 for Al (mainly CO) and 1×10^{-12} torr l/sec cm^2 for stainless steel (mainly H_2). After an air bakeout at 100°C (i.e., bakeout in air at atmospheric pressure for 2 hr followed by a vacuum bakeout for 18 hr) outgassing rates of 2.8×10^{-14} torr l/sec cm^2 (Al) and 1×10^{-13} torr l/sec cm^2 (s.s.) are obtained. For stainless steel an air bakeout at 400°C followed by a 18 hr vacuum bakeout gives outgassing rates in the low 10^{-14} torr l/sec cm^2 range. These low outgassing rates of stainless steel are not affected by subsequent chemical etching or by mechanical polishing: outgassing rates of below 2×10^{-13} torr l/sec cm^2 can be achieved routinely from such samples after a 20 hr vacuum bakeout at 100°C. (auth)

20323 (UCRL-76537) ENTHALPY AND HEAT CAPACITY OF LIQUID PLUTONIUM AND URANIUM. Thayer, W. L.; Robbins, J. L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 9 Jul 1975. 9p. (CONF-750915-1). Dep. NTIS $4.00.

From 5th international conference on plutonium and other actinides; Baden–Baden, F.R. Germany (10 Sep 1975).

The enthalpy and effective heat capacity of delta-plutonium (Pu–1 wt percent Ga-delta alloys) and oralloy (enriched U) at temperatures high in the liquid region were measured. The Super Kukla prompt-burst reactor was used to heat thin wafers of these metals by neutron-induced fission. The temperature increase in the samples was measured with thermocouples and the number of fissions in the sample determined radiochemically. From these data, heat capacity and enthalpy were calculated. For oralloy, a linear relationship was obtained between reactor-core temperature rise and energy deposition for both thermocouple data and radiochemical yields. Also, these two sets of independent data agreed with each other to within +–5 percent for all experiments. The heat capacity of oralloy was calculated as 159 J/kg.°C up to 2200°C. For delta-plutonium, the same linear relationship was observed for thermocouple data. The oralloy data and the plutonium thermocouple data were used to calculate an oralloy-to-plutonium fission ratio of 0.93 and a constant value of 180 J/kg.°C was computed for the effective heat capacity of liquid delta-plutonium up to 2200°C. Because molten plutonium and uranium would chemically attack even the most refractory crucible materials, it would be very difficult to obtain such data by conventional laboratory calorimetry it appears that the use of neutron heating in these investigations is unique. (auth)

20324 (Y-1984) STUDY OF THE RETENTION OF METASTABLE PHASES IN QUENCHED URANIUM–NIOBIUM–ZIRCONIUM TERNARY ALLOYS. Cooper, R. H. Jr. (Oak Ridge Y-12 Plant, Tenn. (USA)). Aug 1975. Contract W-7405-eng-26. 43p. Dep. NTIS $4.00.

A metastable or transitional phase diagram for the uranium-rich section of the U–Nb–Zr ternary system was proposed for alloys quenched from 850°C. A review of those alloys having a bcc and a displaced bcc structure revealed a linear relation between the bcc lattice parameters and alloy content, which approximately obeys Vegard's Law over the range of compositions investigated. The monoclinic angle, gamma, was found to be linearly related to the Nb and Zr contents. Metallographic examination of the samples having a monoclinic structure indicated that these samples had a Widmanstatten structure. The DPH hardness of all alloys regardless of crystal structure was found to be related to the niobium and zirconium contents by the following equation: DPH equals $44.9 + 0.45\ Nb^2 + 8.8\ Zr$. (25 figures) (auth)

20325 RARE EARTH ADDITIONS TO ELECTRIC FURNACE STEELS FOR SULFIDE SHAPE CONTROL. Bennett, H. W.; Sandell, L. P. Jr. J. Met.; 26: No. 2, 21-24(Feb 1974).

The effects of inclusion sulfide morphology on notch toughness of steels are examined. It was found that additions of Ti, Zr, and rare earths form sulfide inclusions that are globular instead of the stringer type usually found in hot rolled steels. This change in sulfide morphology improves the transverse notch toughness of the steel. (JRD)

20326 DEPENDENCE OF THE GINZBURG–LANDAU PARAMETER k ON THE THICKNESS OF THIN CYLINDRICAL SUPERCONDUCTING INDIUM FILMS NEAR T_c. Bohdziewicz, A.; Makiej, B. (Polish Academy of Sciences, Wroclaw). Acta Phys. Pol., Ser. A.; 47: No. 3, 323-327(1975).

On the basis of the results of resistance ratio $r_R = R_{300}/R_{4.2}$ measurements the electron mean free path in temperature 4.2°K and the values of the dimensionless parameter κ of the Ginzburg-Landau theory in temperature $\approx$ 3.4°K were determined for thin cylindrical indium films with thickness varied from 0.4 to 10.4 × 10^{-5} cm. (auth)

20327 THERMAL AND ELECTRICAL CONDUCTIVITY OF MATERIALS BASED ON TITANIUM AND ITS ALLOYS AT TEMPERATURES FROM 20 TO 1000°K. Ermolaev, B. I. Met. Sci. Heat Treat.; 16: No. 11-12, 1049-1051(1974).

Translated from Metalloved. Term. Obrab. Metal.; 16: No. 12, 46-47(Dec 1974).

Data are presented on the thermal and electrical conductivity of titanium alloys OT4 (2% Al, 1.5% Mn), VT6 (5% Al, 4% V), VT8 (6% Al, 3.5% Mo, 0.25% Si), and TS5(5.5% Al, 1.5% V, 2.5% Sn), and also commercially pure titanium VT1 (99.2% Ti) and iodide titanium (≤99.9% Ti). The results are discussed and presented in tables and plots. (JRD)

20328 PROPERTIES OF STAINLESS STEELS OF THE TRANSITION CLASS AFTER COLD PLASTIC DEFORMATION. Burkin, V. S.; Shein, A. S.; D'yakov, Yu. I. Met. Sci. Heat Treat.; 16: No. 11-12, 1031-1033(1974).

Translated from Metalloved. Term. Obrab. Metal.; 16: No. 12, 31-33(Dec 1974).

Results of deformation by cold upsetting of cylyndrical stainless steel specimens are presented. Results show that for stainless steels of the transition class the highest strength properties are obtained by multiple cold plastic deformation and subsequent aging. For unaged stainless steels of the austenitic–martensitic class there is no direct relationship between the amount of martensite and the strength characteristics. (JRD)

20329 STRUCTURE AND PROPERTIES OF STAINLESS STEEL ALLOYED WITH MOLYBDENUM. Sorokina, N. A.; Ul'yanin, E. A.; Fedorova, V. I.; Kaputkin, I. I.; Belyaeva, V. A. Met. Sci. Heat Treat.; 16: No. 11-12, 1027-1030(1974).

Translated from Metalloved. Term. Obrab. Metal.; 16: No. 12, 27-30(Dec 1974).

Two series of heats were melted containing various different quantities of C and Mo. Results of tensile tests on these specimens show that raising the molybdenum content from 0.9 to 3.7% in austenitic steel with 19% Cr, 10% Mn, 7% Ni, and 0.30% N raises the ultimate strength to 93 kg/mm^2 and the yield strength to 58 kg/mm^2. In the steel not containing molybdenum, tempering at 800°C leads to the formation of M_2N and $M_{23}C_6$; the addition of molybdenum in amounts over 2.1% leads to preferential formation of σ phase during tempering. Raising the carbon content from 0.01 to 0.11% lessens the tendency to form σ phase in austenitic steel with 2.5% Mo and leads to formation of $M_{23}C_6$ carbide. (auth)

20330 EFFECT OF DIAMOND BURNISHING ON THE FATIGUE STRENGTH OF STEEL 40 KhNMA AT ELEVATED TEMPERATURES. Yatsenko, V. K.; Zaitsev, G. Z. Met. Sci. Heat Treat.; 16: No. 11-12, 1020-1022(1974).

Translated from Metalloved. Term. Obrab. Metal.; 16: No. 12, 21-23(Dec 1974).

Work hardened samples were heat treated at 300°C for 5 h. The surface quality was judged from the roughness and residual stresses. It was found that the effect of diamond burnishing on the fatigue strength diminishes only slightly at elevated temperatures. Additional tempering at a temperature exceeding the operating temperature of shafts increases the resistance of the surface layer formed by burnishing. (auth)

20331 STUDY OF TRANSFORMATIONS IN BERYLLIUM BRONZES BY MEANS OF INTERNAL FRICTION. Kaplun, Yu. A.; Pastukhova, Zh. P.; Piguzov, Yu. V. (Moscow Technical College). Met. Sci. Heat Treat.; 16: No. 11-12, 982-984(1974).

Translated from Metalloved. Term. Obrab. Metal.; 16: No. 11, 70-72(Nov 1974).

The effects of microadditions of Mg to Be bronzes were investigated. It was found that microalloying of beryllium bronze with magnesium and phosphorus changes the character of the amplitude dependences of internal friction in the quenched condition, which is due to a difference in the concentrations and mobility of point defects, depending on the energy of the bond with impurity atoms. For beryllium bronze of the BNT1.9-type there is a correlation between the changes in the basic parameters of internal friction characterizing the increase of resistance to movements of structural defects and the elastic limit. For beryllium bronzes microalloyed with magnesium or with magnesium and phosphorus there is no correlation between the changes in the parameters of internal friction and the elastic limit. Microalloying has a stronger effect in the early stages of aging than in the later stages, since the pinning of structural defects is considerably larger than in standard bronze. Two stages were noted in the process of hardening of beryllium bronzes microalloyed with magnesium and with magnesium and phosphorus. These stages in the increase of the reversible mobility of structural defects are distinguishable after aging at 340°C for 2 h. (auth)

20332 MAGNETIC PROPERTIES OF Ni-Fe-Mo TAPE IN RELATION TO TECHNOLOGICAL FACTORS. Starostin, Yu. V.; Krasnykh, V. I.; Lyubenko, E. A.; Bocharov, V. I. Met. Sci. Heat Treat.; 16: No. 11-12, 957-959(1974).

Translated from Metalloved. Term. Obrab. Metal.; 16: No. 11, 50-53(Nov 1974).

The effects of melting, rolling and heat treatments on the magnetic properties of this alloy were investigated. It was found that with increasing concentrations of molybdenum in the alloy the cooling rate at which the highest values of the right-angle factor are attained decreases. With increasing thickness of the tape the rolling reduction ensuring the highest values of the right-angle factor increases. For tape with a low molybdenum content the right-angle factor can be increased by use of step annealing (high-temperature annealing, rapid cooling, and holding for several hours at 460 to 420°C). Tapes from open heats with additions of manganese and silicon and tapes from vacuum heats not deoxidized with manganese and silicon have the same magnetic properties, while tapes from vacuum heats with manganese and silicon have a lower coercive force and higher permeability. (auth)

20333 EFFECT OF HEAT TREATMENT ON PHASE COMPOSITION OF NIOBIUM ALLOYS. Kuz'minskaya, L. N.; Sosulina, I. A. Met. Sci. Heat Treat.; 16: No. 11-12, 951-952(1974).

Translated from Metalloved. Term. Obrab. Metal.; 16: No. 11, 45-46(Nov 1974).

The phase compositions of niobium alloys of the Nb-W-Zr-Ta-C and Nb-W-Zr-Mo-C systems in relation to the holding time at 1100°C after recrystallization annealing at 1400°C and high-temperature annealing at 1800°C were studied. Results show that the phase composition of Nb-W-Zr-Ta-C alloys is more stable than that of Nb-W-Zr-Mo-C alloys at 1100°C. Greater hardening of Nb-W-Zr-Ta-C alloys can be expected because the precipitating carbide phase of the MC-type, rich in zirconium, is a more effective hardening phase. (auth)

20334 INCLUSIONS IN TUNGSTEN AND ITS ALLOYS. Savitskii, E. M.; Povarova, K. B.; Skotnikov, S. A. Met. Sci. Heat Treat.; 16: No. 11-12, 948-950(1974).

Translated from Metalloved. Term. Obrab. Metal.; 16: No. 11, 42-45(Nov 1974).

The effects of nonmetallic inclusions on the brittle fracture of W were investigated. It was found that a single strong discharge in an atmosphere of high-purity helium or air induces erosion of nonmetallic inclusions in tungsten, which permits spectral analysis of the inclusion material extracted in the plasma and also facilitates observation of inclusions on microsections and microprobe analysis of them. The most erosion resistant inclusions in tungsten are carbides, and oxides such as SiO_2 and Al_2O_3. Inclusions of more complex composition, containing silicon, aluminum, magnesium, calcium, barium, and potassium together are eroded more easily. Metallic impurities (titanium, iron, zirconium, and others) are found in the solid solution or in negligible quantities in high-melting impurities. Along with carbides and oxides, there are some inclusions with hydrogen and nitrogen, probably of the type of carbonitrides, oxynitrides, or oxyhydrides. (auth)

20335 SUSCEPTIBILITY TO BRITTLE FRACTURE OF TUNGSTEN DEPOSITED FROM THE GASEOUS PHASE. Kleiner, L. M.; Andreev, Yu. V.; Chuzhko, R. K.; Khusainov, M. A. Met. Sci. Heat Treat.; 16: No. 11-12, 945-947(1974).

Translated from Metalloved. Term. Obrab. Metal.; 16: No. 11, 40-42(Nov 1974).

The effects of annealing temperature on the mechanical properties and microstructure of vapor deposited W were investigated. It was found that annealing of tungsten in vacuum substantially reduces the ductile-brittle temperature (T_{cr}) (from 1000 to 350°C). Results of metallographic and x-ray analyses indicate that the lowering of T_{cr} is not due to a change in the crystal structure of tungsten. Lowering T_{cr} by 500 to 600°C substantially increases the operational reliability of tungsten coatings with sharp changes in temperature. Annealing conditions must be selected in accordance with the specific operating conditions and design of machine parts. (auth)

20336 EFFECT OF GRAIN SIZE AND AGING PROCESSES ON DUCTILE-BRITTLE TRANSITION TEMPERATURE IN MOLYBDENUM ALLOYS. Morgunova, N. N.; Kazakova, N. I. Met. Sci. Heat Treat.; 16: No. 11-12, 941-944(1974).

Translated from Metalloved. Term. Obrab. Metal.; 16: No. 11, 36-40(Nov 1974).

These effects were studied in pure Mo, and in Mo alloys with additions of C, Zr, and B. It was found that high-carbon biphase molybdenum alloys of the Mo-Zr-C system are characterized in the recrystallized condition by a broad range of the values of ductile-brittle transition temperature (T_x) from the upper limit down to 500°C; the determining factor is the grain size, with no change in the transcrystalline character of the fracture. Aging processes affect T_x mainly due to the grain refining that occurs during aging, and also the phase transformations. The transition temperature of low-carbon Mo-C and Mo-Zr-B alloys in the recrystallized condition is determined by the character of failure. For these alloys the value of T_x varies within a narrower range, although the upper limit is above room temperature and reaches 180°C. In this case the determining factor is the ratio of intergranular to transcrystalline fracture. Intergranular fracture occurs after aging in the process of which carbide phase is precipitated and the dislocation arrays change. In this connection, the most promising direction for development of weldable alloys based on molybdenum is to create alloys with the least tendency to grain growth that retain transcrystalline fracture at the highest possible annealing temperature. (auth)

20337 CHARACTER OF FRACTURE IN STEEL Kh17N13M3T WITH BORON IN DIFFERENT STAGES OF CREEP. Rozenberg, V. M.; Morozov, Yu. A.; Sidel'kovskii, M. P.; Gordeeva, L. I. Met. Sci. Heat Treat.; 16: No. 11-12, 938-940(1974).

Translated from Metalloved. Term. Obrab. Metal.; 16: No. 11, 33-35(Nov 1974).

The effects of B additions on the strength, microstructure, and fracture properties of this steel were studied. It was found that intragranular and intergranular processes that occur during creep in steel Kh17N13M3T without boron and with 0.0015 and 0.003% B affect the character of fracture in the initial stage of steady-state creep; the percentage of intercrystalline components increases and the block size decreases. The ratio of the intercrystalline to the intracrystalline sections of the fracture and the block size established in the initial stage of steady-state creep do not change during this stage. In steels with boron the

percentage of the intercrystalline component after creep is smaller (20 to 30%) than in the steel without boron (~75%), i.e., small additions of boron inhibit damage in the grain boundaries during creep. In samples of steel Kh17N13M3T with 0.0015% B, with the highest long-term strength, the size of the blocks formed in the process of creep is smaller than in the steel without boron or with 0.003% B. Evidently creep is more even in this steel. (auth)

20338 GRAIN SIZE AND HEAT RESISTANCE OF Cr–Mo–V STEEL. Trusov, L. P.; D'yachenko, S. S.; Tarabanova, V. P.; Mishchenko, L. D. Met. Sci. Heat Treat.; 16: No. 11-12, 935-937(1974).

Translated from Metalloved. Term. Obrab. Metal.; 16: No. 11, 29-33(Nov 1974).

The effects of grain size on the short-term and long-term mechanical properties of cast 15Kh1M1F steel were investigated. It was found that a reduction of the grain size of cast parts of steel 15Kh1M1F from 40 to 15 μ increases the probability of obtaining high ductility at room temperature and higher values of the long-term ductility at 565°C. The long-term strength is hardly affected by grain refining within these limits, and depends mainly on the ratio of the structural components. To ensure maximum values of the long-term ductility of cast parts of boilers and turbines it is necessary to study the factors controlling the optimal grain size. (auth)

20339 PROPERTIES OF 12% Cr STEELS IN RELATION TO ALLOYING. Lanskaya, K. A.; Koreshkova, A. M. Met. Sci. Heat Treat.; 16: No. 11-12, 931-934(1974).

Translated from Metalloved. Term. Obrab. Metal.; 16: No. 11, 26-29(Nov 1974).

The effects of alloying additions of selected elements on the structure and properties of 12% Cr steel were studied. It was found that the creep resistance of 12% Cr–W–Mo–V–Nb steel is increased most effectively by alloying with zirconium, nitrogen, and aluminum due to the formation of nitrides, with the ductility remaining fairly high. With increasing concentrations of tungsten and molybdenum (up to 1.6%) the time to failure decreases slightly, while the addition of up to 2.0% Si, 0.7% Nb, 0.6% V, 0.4% Y, and 1.3% Ni substantially reduces the creep resistance due to the larger percentage of ferrite in the alloy, the lowering of the critical points, and weakening of atomic bonds in the crystal lattice. (auth)

20340 CHEMICAL AND STRUCTURAL HETEROGENEITY OF LARGE FORGINGS OF ROTOR STEELS. Bashnin, Yu. A.; Korovina, V. M.; Chernukha, L. G. (Moscow Inst. of Steel and Alloys). Met. Sci. Heat Treat.; 16: No. 11-12, 927-930(1974).

Translated from Metalloved Term. Obrab. Metal.; 16: No. 11, 22-25(Nov 1974).

Results of studies on the chemical and structural heterogeneity of large forgings of rotor steels are presented and discussed. It is concluded that the chemical heterogeneity and the structural heterogeneity through the section of large forgings that occur during heat treatment must be taken into consideration in selecting the holding temperature in order to reduce the susceptibility of rotor steels to hydrogen embrittlement. The temperature must not exceed the intermediate transformation range for microvolumes with an excess concentration of alloying elements because austenite would be formed, with subsequent enrichment in hydrogen and the possibility of hairline cracks forming during later cooling. (auth)

20341 LOW-CARBON MANGANESE STEELS WITH VANADIUM CARBONITRIDES. Gulyaev, A. P.; Nikitin, V. N.; Akhundov, Ya. M. Met. Sci. Heat Treat.; 16: No. 11-12, 908-912(1974).

Translated from Metalloved. Term. Obrab. Metal.; 16: No. 11, 4-8(Nov 1974).

The effects of manganese content on the properties of steels containing additions of V and N were studied. It was found that vanadium carbonitride phase in low-carbon steel improves the strength characteristics. The increase in strength due to vanadium carbonitrides depends on the structure in which the carbonitride particles precipitate and, consequently, on their dispersion. With precipitation of vanadium carbonitrides in ferrite, i.e., in the upper range of transformation temperatures, the yield strength is higher than for the same steel without carbonitride phase. With precipitation of vanadium carbonitrides in bainite the yield strength increases. Low carbon, low-alloy, high-manganese steel 03G4AF is recommended (up to 0.05% C, 0.25 to 0.50% Si, 3.9 to 4.5% Mn, 0.07 to 0.15% V, 0.015 to 0.022% N, up to 0.015% S, up to 0.015% P, and 0.02 to 0.05% Al), which has good weldability and the following mechanical properties: σ_b = 70 kg/mm^2, $\sigma_{0.2}$ = 60 kg/mm^2, δ = 20%, ψ = 60%, a_{n-60} = 5 kg-m/cm^2, T_{50} = −10°C in the tempered condition after hot rolling; σ_b = 70 kg/mm^2, $\sigma_{0.2}$ = 60 kg/mm^2, δ = 25%, ψ = 55%, a_{n-60} = 8 kg-m/cm^2, T_{50} = −30°C in the improved condition. (auth)

20342 COMPOSITE ALLOY. Piatti, G.; Matera, R. (to Commission of the European Communities). Netherlands Patent 7,208,934/A/. 28 Jun 1972. 4p. (In Dutch).

The possible compositions of a nickel base alloy on a nickel matrix containing fibers or whiskers which are oriented in the same direction, are described. This alloy is particularly suitable for the manufacture of objects that are subject to high temperatures in a specific direction. (INIS)

20343 LOW TEMPERATURE HEAT CAPACITY AND MAGNETIC STUDIES ON $DyCu_6$. Narasimhan, K. S. V. L.; Klein, M. J.; Butera, R. A. (Univ. of Pittsburgh). J. Solid State Chem.; 14: No. 3, 313-316(Jul 1975).

Low-temperature heat capacity studies on $DyCu_6$ revealed a λ-anomaly at 6.55°K. Evaluation of the entropy indicated that the ground state is not (2J + 1) fold degenerate. High field magnetization data yield a moment of 9.28 μ_B at 4.2°K and 120 kOe. (auth)

20344 SUPERCONDUCTIVITY OF VAPOUR-QUENCHED LANTHANIDE FILMS. Reale, C. (Centro Richerche Pellicole Sottili, Milan). Thin Solid Films; 28: No. 1, L29-L30(Jul 1975).

Microcrystalline ultra-pure films (100–2100 Å thick) of all stable lanthanides were vapor-quenched onto smooth, clean alkali-zinc borosilicate substrates at 4.2°K. After resistance measurements at varying temperature (T), the films were cyclically annealed at increasing T. The resistance of La, Ce, Pr, Nd, Eu, and Yb dropped to near zero. (The other eight stable lanthanides did not show superconductivity down to 0.1°K.) The superconducting T_c decreases irreversibly with annealing temperature until superconductivity is quenched (Eu, Yb) or T_c reaches a limiting value (La, Ce, Pr, Nd). T_c decreases monotonically with increasing film thickness. Results suggest that the phonon-induced attractive electron–electron interaction is enhanced by the lattice distortions and discontinuities frozen in during film deposition. (DLC)

20345 CORRELATIONS BETWEEN INTERFACIAL OXIDES AND RESISTANCE CHANGES FOR W CONTACTS ON HEAVILY DOPED Si–Ge. Sweet, J. N.; Holloway, P. H. (Sandia Labs., Albuquerque, NM). Thin Solid Films; 27: No. 2, 263-271(Jun 1975).

The effects of variations in processing on the thickness of an interfacial oxide and the resistance between W contact films and doped Si–Ge alloy have been investigated. Auger electron spectroscopy in conjunction with sputter profiling indicated that the native interfacial oxide film could be reduced by 50% with an HF etch immediately prior to deposition of the W film. The interfacial oxide was found to thicken by approximately one monolayer upon being heated to 400°C for 3 h in a sputtering vacuum chamber with a 3×10^{-2} torr argon atmosphere. This was correlated with a doubling in the contact resistance. The manner in which interface oxide could cause this increase in contact resistance is discussed. (auth)

20346 IDENTIFICATION OF MONOLAYER STRUCTURES BY FIELD-ION MICROSCOPY. Janssen, A. P.; Jones, J. P. (University Coll. of North Wales, Bangor). Thin Solid Films; 28: No. 1, L25-L28(Jul 1975).

Si films formed by low-temperature migration across a W field-emitter tip were observed by field-emission and field-ion microscopy (FIM) at 78°K. Results indicate coherent growth of Si on W(211). It is concluded that FIM allows the structure of monolayer films to be determined on selected substrate planes which have a well-resolved surface lattice. (DLC)

20347 CONDENSATION AND EPITAXIAL GROWTH OF K ON W(001). Steinhage, P. W.; Mayer, H. (Technical Univ., Clausthal, Germany). Thin Solid Films; 28: No. 1, 131-147(Jul 1975).

The growth of K layers on W(001) from the first adsorption phases up to the deposition of thick films was investigated by means of a RHEED camera, at 143 to 273°K. At first the deposited potassium atoms form a W(001)-c(2 × 2)K^+ structure, upon which a nonionized but polarized adstructure grows. Further condensation is characterized by a very low binding energy of 0.09 eV to the substrate layer and consequently by a low condensation coefficient. The transition layer grows out of single adsorption events without the formation of nuclei, while the epitaxial layers growing upon it are initiated by three-dimensional nucleation. For these layers, epitaxial orientations K(001)//W(001) with K[001]//W[010] or K[001]//W[100] were observed. (auth)

20348 GROWTH OF SODIUM ON A TUNGSTEN(100) SURFACE. Mlynczak, A.; Niedermayer, R. (Ruhr Universitat Bochum, Germany). Thin Solid Films; 28: No. 1, 37-58(Jul 1975).

The growth of sodium on a W(100) surface was investigated for coverages between 0 and 100 monolayers (ML). Determination of the coverage, structure, shape, desorption energy, diffusion energy on the substrate, condensation coefficient and binding energy of the film atoms was achieved in the same experiment. The films

grow pseudomorphically layer by layer up to 80 ML in a W(100)-c (2×2)Na structure. The strain is 4%. The first layer is strongly bound (2.5 eV) and forms an intermediate layer for subsequent growth. The binding energy of the second to fifth layers decreases monotonically from 1.27 to 1.06 eV; the diffusion energy on top of the intermediate layer is 0.54 eV. The condensation coefficient increases with temperature to a maximum of 0.9 and then decreases sharply to zero. The layer growth is in general agreement with the rule $\Delta E_{des} - \eta_s \Delta E_{sd} \{> A_0/3$ for two-dimensional growth, $< A_0/3$ for three-dimensional growth} which is also established for other systems, and the pseudomorphic growth is in agreement with the rule $\Delta E_{sd} \{ > [(b-a)^2/b^2] \ 100A_0$ for pseudomorphic growth], $< [(b-a)^2/b^2] \ 100A_0$ for interfacial dislocations]). The temperature dependence of the condensation coefficient is not fully understood. (auth)

20349 EARLY STAGES OF CONDENSATION OF LEAD ON TUNGSTEN. Bauer, E.; Poppa, H.; Todd, G. (Ames Research Center, Moffett Field, CA). Thin Solid Films; 28: No. 1, 19-36(Jul 1975).

The growth of the first few layers of Pb on W {110} and {100} single-crystal surfaces was studied by AES, LEED, work function measurements, and thermal desorption spectroscopy in one combined experimental system also equipped with a quartz oscillator for absolute thickness determinations. Results show striking differences in film growth between {110} and {100} surfaces and a strong dependence of growth upon temperature on the {100} surface. (auth)

20350 AMPLITUDE-DEPENDENT DAMPING IN ZIRCONIUM. Fernandez, L.; Povolo, F. (Comision Nacional de Energia Atomica, Buenos Aires). Philos. Mag.; 31: No. 5, 1081-1098(May 1975).

The amplitude-dependent damping and modulus defect of high-purity polycrystalline zirconium specimens were measured, in the kilocycle frequency range in longitudinal vibrations, between liquid nitrogen and room temperatures. The influence of temperature strain amplitude, strain distribution, and hydrogen content on the damping spectrum is considered. The results are interpreted in terms of an interaction between dislocations and hydrogen atoms and several parameters such as dislocation density, dislocation loop length, diffusion coefficient, dislocation damping constant and binding energy are obtained from the experimental curves. (auth)

20351 DEVIATIONS FROM ADDITIVITY OF LATTICE SPACINGS IN TRANSITION METAL ALLOY SYSTEMS. Raynor, G. V. (Birmingham Univ., Eng.). Philos. Mag.; 31: No. 5, 1099-1112 (May 1975).

Using published lattice spacing/composition curves, deviations Δ a from additivity of lattice spacings were calculated for solid solutions in the metals of groups IVA, VA and VIA of the periodic table of transition metals of group numbers 4 to 11 from the three long periods. The results are presented as typical diagrams. Where the components have the same group number, Δ a is zero unless one component is from the first long period, when Δ a is positive. In such cases the Δ a/composition curves are similar in form. Pairs of systems involving a common component also frequently correspond with similar Δ a/composition curves. Solutes of higher group number than that of the solvent tend to give rise to positive Δ a values, while solutes of lower group number correspond with negative Δ a values. Solution of elements of group number exceeding 4 in titanium, zirconium and hafnium stabilizes the body-centered cubic structure and thereby shortens the mean interatomic distances, giving rise to a lattice contraction that opposes the tendency for solutes of group number higher than that of the solvent to give rise to positive Δ a values. (auth)

20352 SUPERCONDUCTIVITY IN ULTRATHIN FILMS. P. 3. Fluctuations at the Resistive Transition of Beryllium-Aluminium Alloys. Granqvist, C. G.; Claeson, T. (Chalmers Tekniska Hoegskola, Goeteborg (Sweden). Institutionen foer Fysik). Z. Phys., B; 20: No. 3, 241-245(Apr 1975). 5 figs.; 51 refs.

It is shown that the pair breaking parameter of the Maki-Thompson contributions to the fluctuation conductivity above the superconducting transition temperature has the same thickness dependence as the transition temperature depression in very thin amorphous Be-Al films. Both can be ascribed to an extremely thin surface sheath with suppressed superconductivity. (auth)

20353 DIRECT OBSERVATION OF MAGNETIC FLUX IN SUPERCONDUCTORS. Obst, B. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Experimentelle Kernphysik). KFK-Nachr.; 7: No. 1, 15-18(1975). (In German).

6 figs.; 4 refs.

After short description of the phase transition of superconductors of the first and second type, a decoration technique for visualization of magnetic structures with a very clear illustration of the influence of metallurgical properties on the superconductive properties is presented, followed by an explanation of the pinning mechanisms with examples of flux distributions with delayed adjustment to the thermal equilibrium in the outer field. (GE)

20354 CRITICAL CURRENT CARRYING CAPACITY AND ANGULAR DEPENDENCE OF NbTi SUPERCONDUCTORS. Juengst, K. P. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Experimentelle Kernphysik). KFK-Nachr.; 7: No. 1, 19-22(1975). (In German).

7 figs.; 9 refs.

The make-up of a superconductive cable is described. The relation between the critical current and the outer magnetic field at a temperature of 4.2 K is charted in a diagram for this cable. The angular dependence of the critical current density of cold-formed NbTi conductors was also investigated. (HPoe/AK)

20355 PROPERTIES IN INDIUM ANTIMONIDE THIN FILMS AS FAST-RESPONSE PRESSURE TRANSDUCERS. Wlodarski, W. (Technical Univ., Warsaw). Thin Solid Films; 27: No. 2, 217-223(Jun 1975).

Results are presented of studies on the application of InSb thin films for measuring rapidly varying pressures up to 600 atm in liquid non-conducting media. A comparison is made between this transducer and the quartz pressure transducer used as devices for measuring rapidly varying pressures. The dynamic error in a pressure-measuring system which included an indium antimonide thin film resistance transducer has been determined as less than 1.5%. (auth)

20356 FATIGUE CRACK PROPAGATION BEHAVIOR OF THE Ni-Ni_3Cb EUTECTIC COMPOSITE. Mills, W. J.; Hertzberg, R. W. (Lehigh Univ., Bethlehem, PA). pp 5-27 of Fatigue of Composite Materials. Philadelphia; American Society for Testing and Materials (1975).

From symposium on fatigue of composite materials; Bal Harbour, FL (3 Dec 1973).

Room temperature four-point-bending fatigue studies of the unidirectionally solidified Ni-Ni_3Nb eutectic composite were conducted to better understand fatigue behavior in composite materials. Fatigue crack propagation (FCP) data for this eutectic composite alloy revealed a power relationship between the stress intensity factor range and the crack growth rate from 10^{-7} to 10^{-4} in./cycle. This application of fracture mechanics concepts to FCP data represents the first such reported information of its kind for eutectic composites. Fatigue behavior of this eutectic alloy was found to be sensitive to solidification parameters, thermal history, and the mean stress intensity level. Metallographic and electron fractographic examination of the fatigue fracture revealed the FCP mechanism to be a function of the prevailing stress intensity factor at the crack tip with a fatigue fracture mechanism transition occuring between 5×10^{-6} and 1.5×10^{-5} in./cycle. At low growth rates, the Ni(gamma) phase exhibited faceting indicative of Stage I propagation along active slip planes, while above 5×10^{-6} in./cycle, the gamma fracture surface was characterized by the presence of fatigue striations which laid parallel to the Ni-Ni_3Nb interface. At both high and low growth rates, the fatigue response of the Ni-Ni_3Nb composite was controlled by the gamma lamellae. (32 references, 14 fig.) (auth)

20357 PROCESSES IN THE SINTERING OF TECHNICAL MOLYBDENUM ALLOYS ESPECIALLY WITH Ti, Zr AND C, AND INFLUENCE ON THE PROPERTIES OF FINAL PRODUCTS. Eck, R. Metall; 28: No. 12, 1147-1151(Dec 1974). (In German).

8 figs.; 3 refs.

The advantages of molybdenum alloys are indicated. Following a presentation of the sintering problems of TZM (Mo base alloy with 0.5% Ti, 0.7% Zr and 0.01 to 0.04% C), the influence of various added amounts to alloy elements is dealt with. The influence of different amounts of carbon on the carbon-oxygen balance at various sintering conditions and various amounts of Ti, Zr, and C on the recrystallization and grain growth behavior and on the tensile properties of this alloy are discussed. The tensile strength and breaking tension values depending on the manner and degree of deformation due to rolling, hammering, and extrusion are given for TZM. Heat resistance values are given for a TZM sheet with 94% deformation. Single phase alloys are mentioned using the example the molybdenum alloy with cobalt addition where the recrystallization behavior of molybdenum, doped molybdenum and TZM wire from tensile tests depending on annealing temperature are compared and discussed. (GE)

20358 COARSENING OF INTERGRANULAR BUBBLES CONTAINING SPARINGLY SOLUBLE MONATOMIC GAS. Greenwood,

G. W. (Univ. of Sheffield, Eng.). Philos. Mag.; 31: No. 3, 673-678(Mar 1975).

When gas bubbles of varying sizes exist in a material, the higher concentration of gas in solution around the smaller bubbles results in a net migration of gas atoms towards the larger bubbles which grow at the expense of the smaller ones. The driving force is derived from the consequent increase in entropy of the system. When the bubbles are situated on grain boundaries and the gas is preferentially segregated at the boundaries, the gas migration may be confined mainly to the boundary planes. The bubble-coarsening process in such a situation is analysed in terms of gas atom diffusion along the grain boundaries and an equation is derived for the increase in mean bubble size. The possible significance of the coarsening mechanism in the development of intergranular porosity and life limitation of doped tungsten lamp filaments operating at high temperature is suggested. (auth)

20359 PULSED SUPERCONDUCTING MAGNETS. Turowski, P. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Experimentelle Kernphysik). KFK-Nachr.; 7: No. 1, 10-14(1975). (In German).

7 figs.; 14 refs.

Experiments with a pulsed superconducting dipole magnet are reported, which had a lost power of 50 watts at 0.1 Hz pulse frequency and 4.5 tesla field amplitude. The mechanic and electric magnetic field conceptions are discussed. At 4.5 tesla the magnet has a field inhomogeneity of 3×10^{-3}. (GE)

20360 SHORT-RANGE ORDER IN MOLTEN INDIUM ANTIMONIDE. Krebs, H.; Sutter, J.; Thurn, H. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Anorganische Chemie). Z. Phys. Chem. (Frankfurt); 92: No. 4-6, 349-353(Oct 1974). (In German).

1 fig.; 11 refs.

By means of a camera developed on the basis of the Bragg-Brentano-method, the x-ray scattering intensity of the molten InSb was remeasured at different temperatures and from this the atomic distribution curves were determined. (GE)

20361 EDELSTAEHLE FUER KERNKRAFTWERKE. (Fine Steels for Nuclear Power Plants). Witten, F. R. Germany; Edelstahlwerk Witten A. G. (1972). 24p. (In German).

9 figs.; 5 tabs. Printed matter no. 0124/9.

The properties of steels which are often used in the construction of nuclear power plants are examined. Chemical composition, mechanical properties, and uses of noncorrosive, high-temperature resistant steels and alloys are summarized. (GE)

20362 HIGH-TEMPERATURE SUPERCONDUCTIVITY IN THE $BaPb_{1-x}Bi_xO_3$ SYSTEM. Sleight, A. W.; Gillson, J. L.; Bierstelt, P. E. (E. I. Du Pont de Nemours and Co., Wilmington, DE). Solid State Commun.; 17: No. 1, 27-28(1 Jul 1975).

Phases of the type $BaPb_{1-x}Bi_xO_3$ have been prepared for the first time. These phases all have perovskite related structures, and superconductivity was observed over the range $x \approx 0.05$ to 0.3. The highest critical temperature is 13°K which is exceptionally high for an oxide and is much higher than that previously observed for any superconductor not containing a transition element. Semiconducting behavior is observed from $x = 1$ to about 0.35. (auth)

20363 DISLOCATION DAMPING IN STRAINED AND AGED ZIRCONIUM ALLOYS. Atrens, A. (Atomic Energy of Canada, Ltd., Manitoba). J. Aust. Inst. Met.; 20: No. 1, 51-58(Mar 1975).

With increasing strain amplitude, iodide-refined zirconium, having a dislocation cell structure formed by both straining and ageing at 300°C, exhibited a damping peak that was due to the complete breakaway of dislocations from their pinning points. With increasing prestrain, the peak height increased so that it was proportional to the strain at which the peak occurred, with the constant of proportionality decreasing with increasing ageing time. The peak height increase was due to a dislocation structure reordering such that the average loop length between dislocation nodes increased. (auth)

20364 ELECTRICAL RESISTANCE AT THE ANTIFERRO–PARAMAGNETIC TRANSITION IN DYSPROSIUM. Rao, K. V. (Kungliga Tekniska Hoegskolan, Stockholm); Rapp, O.; Johannesson, C.; Geldhaart, D. J. W.; Richards, T. G. J. Phys., C (London); 8: No. 13, 2135-2148(7 Jul 1975).

High precision data for the electrical resistance of dysprosium in the region of the Néel point have been obtained using a direct current comparator method. Results are given for both b- and c-axis samples cut from the same high quality monocrystal. In the immediate vicinity of the Néel point ($|T-T_N| \leq 2.5$°K), the c-axis resistance, R_c, cannot be convincingly described by a power law. Reasons for this are discussed. However, R_c is described by a power law for $2.5 \lesssim T - TN \lesssim 60$°K and for $-15 \lesssim T - T_N \lesssim -2.5$°K with exponents $\phi_+ = 0.60$ and $\phi_- \simeq 1.25$ respectively. In the case of b-axis data, R_b is linearly dependent on T for $T \geq T_N$, whereas a power law, of weak amplitude but with $\phi_- \simeq 1.25$, is valid below T_N. The results suggest that dR/dT varies as the magnetic specific heat below T_N for both the b- and c-axis resistance. (auth)

20365 EXCITATION SPECTRUM OF A MAGNETIC SPIRAL STRUCTURE IN A HEXAGONAL LATTICE. Arai, T.; Felcher, G. P. (Argonne National Lab., IL). J. Phys., C (London); 8: No. 13, 2095-2110(7 Jul 1975).

A magnetic spiral structure with propagation vector Q parallel to a hexagonal crystal axis (as exhibited by holmium metal) is perturbed by the hexagonal crystal field anistropy, introducing modulations $Q \pm 6Q$. By calculating spin deviations from the modulated spiral, the spin Hamiltonian is generated. The Hamiltonian exhibits interactions between the modes $\omega(q)$ and $\omega(q \pm 6Q)$, but is shown to be diagonalized in terms of a new set of independent modes by a novel, non-unitary transformation. Numerical results, which are obtained by using exchange coupling parameters determined at higher temperature (where the hexagonal field is negligible) predict the change in the shape of the spin wave spectrum of holmium at lower temperatures where the field effect is appreciable. From the spin wave spectrum the magnetic zero-point motion is evaluated, and this is found to be larger along the hard directions of the hexagonal plane than along the easy directions. The corresponding modulation of the effective magnetic moments has been calculated numerically for holmium and found to be consistent with recent experimental observations. (auth)

20366 FAST SOLUTE DIFFUSION OF COBALT IN fcc DELTA PLUTONIUM. Charissoux, C.; Calais, D.; Gallet, G. (CEN de Fontenay-aux-Roses, France). J. Phys. Chem. Solids; 36: No. 9, 981-985(Sep 1975). (In French).

The serial sectioning method, used to study solute diffusion of ^{60}Co in fcc δ plutonium, gives the following results: $D = 1.2 \times 10^{-2} \exp(-12700/RT)$ cm^2/s in the temperature range 344 to 426°C. Cobalt is a very fast solute in δ plutonium. It diffuses most likely by a dissociative interstitial mechanism in a matrix where self diffusion takes place by a vacancy mechanism. (auth)

20367 LATTICE DYNAMICS OF HCP METALS. Upadhyaya, J. C.; Sinha, H. P. (Agra Coll., India). J. Phys. Chem. Solids; 36: No. 9, 975-980(Sep 1975).

A lattice dynamical model for hcp metals has been developed which considers ion-ion interaction as a five-neighbor central pair potential and electron-ion interaction in a modified form of Bhatia's model. Complete account of the equilibrium of the hcp lattice including the effect of electron pressure has been considered and as a consequence two equilibrium conditions, necessary for the hcp structure, have been obtained and used in the study. Phonon dispersion curves for four hcp metals, Be, Mg, Y, and Ho have been computed for two symmetry directions and a good agreement has been obtained with the neutron data. The results have also been compared with the use of the same model but with a single condition, reported earlier and show in general a significant improvement. (auth)

20368 MICROSTRUCTURAL SCIENCE. Volume 2. Proceedings of the Sixth Annual Technical Meeting of the International Metallographic Society Held September 25–27, 1973, in Beverly Hills, CA. Fritzke, G. P.; Richardson, J. H.; McCall, J. L. (eds.). New York; American Elsevier Publishing Company, Inc. (1974). 255p. (CONF-730973-). $19.95.

From 6th meeting of International Metallographic Society of America; Los Angeles, California, USA (25 Sep 1973).

Separate abstracts were prepared for four papers presented at this meeting. (CH)

For abstracts of individual papers see: 20023, 20257, 20369, and 20370.

20369 INFLUENCE OF PROCESSING VARIATIONS ON MICROSTRUCTURE AND PROPERTIES IN Fe/Co/2–3 PERCENT ALLOYS. Pinnel, M. R.; Bennett, J. E. (Bell Telephone Labs., Columbus, OH). pp 23-28 of Microstructural Science. Volume 2. Fritzke, G. P. (ed.). New York; American Elsevier Publishing Company, Inc. (1974).

From sixth meeting of International Metallographic Society of America; Los Angeles, California, USA (25 Sep 1973). See CONF-730973-.

A microstructural evaluation was used to provide the key to the understanding of the numerous phase changes which occur in this alloy and their influence on drawability and magnetic properties. Samples of two compositions (2.5 percent V and 3.0 percent V) were given the standard processing sequence used in the production of remanent reed electrical contacts with selected alterations in annealing temperatures at several stages. Microstructures were characterized following each step by light microscopy on lightly etched sections using differential

interference contrast and were correlated with the appropriate ternary equilibrium diagram. Results indicate that the typical hot rolled (1200°C) and air cooled structure is composed of a nonequilibrium, vanadium supersaturated, bcc phase produced by a massive transformation during cooling and is also subject to an ordering transformation. The resultant microstructure is too brittle to be drawn into wire. This can be modified by more rapid cooling. However, the hot rolled and ice brine quenched structure which is more martensitic in character and a totally disordered, nonequilibrium, bcc phase provides only modest improvement in ductility. (auth)

20370 EQUILIBRIUM PHASES AND TRANSFORMATIONS IN Fe/Co/2- 3 PERCENT V ALLOYS. Bennett, J. E.; Pinnel, M. R. (Bell Telephone Labs., Columbus, OH). pp 29-33 of Microstructural Science. Volume 2. Fritzke, G. P. (ed.). New York; American Elsevier Publishing Company, Inc. (1974).

From sixth meeting of International Metallographic Society of America; Los Angeles, California, USA (25 Sep 1973). See CONF-730973-.

A study was conducted to determine the boundaries of the two-phase field in Remendur alloys. Quantitative determination of the phase boundaries at 900 to 950°C shows the two-phase alpha$_1$ + gamma field to be narrower than expected from published data. Annealed microstructures are especially sensitive to vanadium content, annealing temperature, and annealing time and, therefore, commercial procedures must be carefully controlled. Rotation of tie-lines in the alpha$_1$ + gamma field indicate that the gamma phase becomes increasingly rich in vanadium and cobalt with decreasing temperature. Upon quenching from the 900 to 950°C range the gamma (fcc) phase undergoes a massive type transformation to a nonequilibrium alpha$_2$ (bcc) phase. During subsequent annealing at 600°C the alpha$_2$ phase decomposes into alpha$_1$' (ordered bcc) and stable gamma. Even after an extended anneal the stable gamma particles are too small for quantitative microprobe analysis. (auth)

20371 SCHMID'S LAW AND PRISMATIC SLIP OF ZIRCONIUM. Akhtar, A. (Univ. of British Columbia, Vancouver). Scr. Metall.; 9: No. 8, 859-861(Aug 1975).

The applicability of Schmid's law (critical resolved shear stress required for plastic deformation) was tested for prismatic slip in Zr. Results show that the critical resolved shear stress is 7.5 MN/m^2 at 295°K and 4.75 MN/m^2 at 623°K and is independent of orientation. It is concluded that in this case, Schmid's law is valid. (DLC)

20372 DYNAMIC STRAIN AGING OF METASTABLE BETA TITANIUM ALLOYS. Rack, H. J. (Sandia Labs., Albuquerque, NM). Scr. Metall.; 9: No. 8, 829-831(Aug 1975).

Two Ti alloys were studied: RMI 38644 (3.4 Al, 8.3 V, 5.8 Cr, 3.9 Zr) solution treated at 927°C, and Beta-III (10.2 Mo, 5.8 Zr, 4.7 Sn) solution treated at 732, 787, 871, or 982°C. Serrated yielding appeared at 200°C and above for Beta-III solution treated at 982°C; no such serrations were observed for RMI 38644 above 260°C. Load/stress drop associated with dynamic yielding increased with temperature for both alloys. Results indicate a beta-omega transformation mechanism in Beta-III and a dislocation-interstitial interaction mechanism in RMI 38644. (DLC)

20373 EFFECT OF HIGH TEMPERATURE EXPOSURE ON MECHANICAL AND ELECTRICAL PROPERTIES OF Ti-6 Al-4V SHEET. Rosen, A.; Nadiv, S.; Bohrer, M. (Technion, Haifa, Israel). Mater. Eval.; 33: No. 6, 135-137; 140(Jun 1975).

Prolonged heat treatment of the Ti-6 Al-4V alloy at temperatures above 800°C under normal atmospheric conditions causes the appearance of oxygen-rich alpha-case on the surface. This alpha-case drastically reduces both the fracture strength and the elongation to fracture of the alloy as well as its surface conductivity. It was found that a linear relationship exists between fracture strength and eddy current conductivity on the surface, which enables the use of the latter as a nondestructive means for the prediction of strength. (auth)

20374 PHASE ANALYSIS OF Al-Ni-V ALLOYS ACCORDING TO THE ANODE POLARIZATION CURVE PARAMETERS. Marshakov, I. K.; Tutukina, N. M.; Myasnikova, K. P. (Voronezh State Univ., USSR). Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.; 18: No. 4, 576-579(1975). (In Russian).

Nickel and vanadium aluminides in alloys of the type $NiAl_3$-VAl_3 and Ni_2Al_3-V_2Al_5 differ significantly in electrochemical properties. Therefore on the anode polarization curves for the alloys in 0.1 N NaOH, each phase corresponds to its own portion of the active solution with a definite passivation potential and limiting current. It was shown that the rate of solution of a phase is directly proportional to the amount of it in the alloy. Use of this dependence is suggested for determination of the phase composition of the alloys. (tr-auth)

20375 SPECIFIC HEATS OF YTTRIUM AND GADOLINIUM AT HIGH TEMPERATURES. Novikov, I. I.; Mardykin, I. P. Sov. At. Energy (Engl. Transl.); 37: No. 4, 1088-1090(Oct 1974).

Translated from At. Energ. (USSR); 37: No. 4, 348-349(Oct 1974).

The specific heat of Y was measured at 1150 to 1700°K; that of Gd, at 1200 to 1800°K, into the molten range. Contributions to the specific heat of Gd were calculated. (DLC)

20376 MULTIPLE SCATTERING OF X-RAYS AND NEUTRONS. II. Neutron Multiple Scattering by an Aluminum Single Crystal. Parente, C. B. R.; Caticha-Ellis, S. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Jap. J. Appl. Phys.; 13: No. 10, 1506-1513 (Oct 1974).

Some experiences of multiple diffraction of neutrons by an aluminum crystal are described. The experimental conditions needed to assure that the results are treatable by the analytical methods developed earlier are discussed. Soller collimators are not adequate in this technique, as they do not limit the vertical divergence of the incident beam; a new type of collimator, described in the text, had a notable result in the peak resolution. The simultaneous differential equations cease to be valid, as expected, when the crystal approaches perfection, that is, in this context, when the mosaic angular spread η is lower than about 0.01"; then, the problem has to be treated dynamically. (auth)

20377 METALLIC MATERIALS FOR ULTRALOW TEMPERATURE. Horiuchi, T. (Kobe Steel, Ltd. (Japan). Asada Fundamental Research Lab.). Denki Gakkai Zasshi; 94: No. 5, 375-382 (May 1974). (In Japanese).

The characteristics of materials used at ultralow temperature are reviewed for use in the space industry, liquefied gas industry, and largescale project of superconductive machinery using LHe as a coolant. Particularly, austenitic stainless steel, aluminum alloys and titanium alloys are described because of their practicability. Their physical properties at very low temperature, particularly specific heat, thermal conductivity, thermal expansion coefficient, and sometimes temperature dependence of electric conductivity, and magnetic permeability must be known to utilize these materials effectively. Stress-strain curves for 0.2% carbon steel and SUS 304 stainless steel, and a load vs elongation curve for market available pure titanium are illustrated to explain mechanical properties. The metals of face centered lattice structure show ductile breakdown irrespective of temperature, but those of body centered lattice structure show transition from ductile to brittle breakdown as temperature falls. Titanium of hexagonal structure shows their intermediate property. The low temperature characteristics of nickel steel and austenitic stainless steel, a series of aluminum alloys, and titanium alloys are listed. (JA)

20378 CRITICAL CURRENT DENSITY IN SUPERCONDUCTING NIOBIUM FILMS. Huebener, R. P. (Argonne National Lab., IL); Kampwirth, R. T.; Martin, R. L.; Barbee, T. W. Jr.; Zubeck, R. B. J. Low Temp. Phys.; 19: No. 3-4, 247-258(May 1974).

The critical current was measured in Nb strips of 1 mum thickness and different widths w prepared by electron-gun vacuum deposition. The substrate temperature during the deposition was varied between room temperature and 800°C. The width of the Nb strips ranged between 20 and 300 mum. Whereas up to 600°C the different substrate temperatures yielded about the same critical current density J/sub c/ (critical current divided by sample cross section), the specimens prepared with 800°C substrate temperature showed a reduction of J/sub c/ by a factor of 4 to 6. In zero applied magnetic field the samples prepared with 400°C substrate temperature or lower showed a decrease of J/sub c/ roughly proportional to w/sup -1/2/. Such behavior can be understood from a homogeneous and field-independent pinning-force density. The critical current data obtained in an applied perpendicular field, for the high-field regime, were compared with Kramer's theory of flux pinning, which assumes plastic shearing of the flux-line lattice around individual pinning sites during flux flow. (auth)

20379 METALLOVEDENIE REDKOZEMEL'NYKH METALLOV. (Metallurgy of Rare Earth Metals). Savitskii, E. M.; Terekhova, V. F. Moscow; Izdatel'stvo Nauka (1975). 271p.

A large volume of experimental material by the authors and the most recent literature data on the production, purification, and physical chemical properties of the rare earth metals are compiled. The interaction of rare earth metals with elements of all groups of the periodic system is examined. Binary and ternary phase diagrams are constructed. The relation of the electron structure of the rare earth metals with their properties and with the formation of new phases and compounds is established. Special attention is given to the production and investigation of the properties of monocrystals of the rare earth metals and their alloys. A detailed description is given of all known and possible areas of use of the rare earth metals in electronics, machine

construction, metallurgy, atomic technology, the aviation industry, and medicine and biology. (tr-auth)

Radiation Effects

Refer also to abstracts 19679 and 20232.

20380 (AECL-5032, pp 45-46) POSITRON SOURCE INDUCED IRRADIATION DAMAGE IN COPPER. Kim, S. M.; Buyers, W. J. L. (Chalk River Nuclear Labs., Ont.). Jan 1975.
In Physics Division progress report, October 1 to December 31, 1974. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

20381 (AERE-R-7961, pp 24-39) ALLOYING, RADIATION DAMAGE, AND MATHIESSEN'S RULE IN PLUTONIUM. Long, K. A. (Univ. of Surrey, Guildford, Eng.). 1975.
From 4th actinides colloquium; Harwell, UK (Jun 1974).
In 4th actinides colloquium.
Experimental results on the additional resistance due to self damage in plutonium, and on the resistance of PuNp alloys are discussed. An explanation is given in terms of resonant scattering, from defects in the first case, and from Np atoms in the second case, both within the Slater-Koster model. In the latter case it is found necessary to introduce local spin fluctuations on the Np atoms, combining this with the resonant scattering on the Np atoms. The variation of the resistance of plutonium with temperature and the deviations from Mathiessen's rule are discussed in the light of these results. (auth)

20382 (CONF-740222-, pp 115-125) MATERIALS PROBLEMS IN STEADY STATE FUSION REACTORS WITH DIRECT CONVERSION. Werner, R. W. (Lawrence Livermore Lab., CA). 1974.
From symposium on engineering for the materials/energy challenge; Albuquerque, New Mexico, USA (28 Feb 1974).
In engineering for the materials/energy challenge. Proceedings of the 14th annual ASME symposium. (American Society of Mechanical Engineers. New Mexico Section).
Some of the potential problems of a materials-metallurgical-chemical nature which may arise in fusion reactors utilizing the magnetic mirror principle and direct conversion of charged particle energy to electricity are enumerated. The effect that the energetic particles (neutrons, ions and neutrals) may have on four main components are discussed. These components are: (1) the first wall of the blanket; (2) the blanket itself; (3) the collector elements of the direct converter; and (4) the injector. The complexity of problems in these areas are enumerated and some possible solutions offered which are considered worthy of further investigation. (auth)

20383 (CONF-740222-, pp 127-132) MATERIALS PROBLEMS IN MAGNETICALLY CONFINED PULSED FUSION REACTORS. Green, W. V.; Yeske, R. A. (Los Alamos Scientific Lab., NM). 1974.
From symposium on engineering for the materials/energy challenge; Albuquerque, New Mexico, USA (28 Feb 1974).
In engineering for the materials/energy challenge. Proceedings of the 14th annual ASME symposium. (American Society of Mechanical Engineers. New Mexico Section).
It is noted that materials in fusion power reactors must function satisfactorily under conditions of intense high energy neutron flux, heat loads, and temperatures ranging from cryogenic to about 1300°K. The competition between fatigue and thermal creep will occur in all pulsed fusion reactors, but with the additional possibility of radiation creep being the dominant deformation mode. The response of structural support members to the effects of neutron irradiation, in pulses, of cyclic temperature transients, and therefore cyclic thermal stresses, and of elevated temperature must be evaluated for each different type of pulsed fusion reactor having different combinations of cyclic stress, steady stress, temperature, flux level, and metal choice. (JRD)

20384 (HEDL-TME-75-32) TENSILE PROPERTIES OF IRRADIATED TZM AND TUNGSTEN. Steichen, J. M. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Apr 1975. Contract AT(45-1)-2170. 34p. Dep. NTIS $4.00.
The effect of neutron irradiation on the elevated temperature tensile properties of TZM and tungsten has been experimentally determined. Specimens were irradiated at a temperature of approximately 720°F to fluences of 0.4 and 0.9 x 10^{22} n/cm^2 (E greater than 0.1 MeV). Test parameters for both control and irradiated specimens included strain rates from 3 x 10^{-4} to 1 s^{-1} and temperatures from 72 to 1700°F. The results of these tests were correlated with a rate-temperature parameter (T ln A/epsilon) to provide a concise description of material behavior over the range of deformation conditions of this study. The yield strength of the subject materials was significantly increased by decreasing temperature, increasing strain rate, and increasing fluence. Ductility was significantly reduced at any temperature or strain rate by increasing fluence. Cleavage fractures occurred in both unirradiated and irradiated specimens when the yield strength was elevated to the effective cleavage stress by temperature and/or strain rate. Neutron irradiation for the conditions of this study increased the ductile-to-brittle transition temperature of tungsten by approximately 300°F and TZM by approximately 420°F. (auth)

20385 (JUL-1158) DIFFUSE NEUTRON SCATTERING ON DEFORMATION FIELDS OF SUBSTITUTIONALLY AND INTERSTITIALLY DISSOLVED DEFECT ATOMS IN METALS. Bauer, G. S. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Festkoerperforschung). Jan 1975. 156p. (In German). Dep. NTIS (US Sales Only) $11.00.
Thesis. Submitted to Bochum Univ., West Germany.
The measurement of the elastic and quasielastic diffuse scattering of neutrons was used to investigate the atomic configuration in the immediate neighborhood of substitutionally and interstitially soluted defect atoms in metals. The method of virtual forces is used to analyze the data. The coupling constants of the pure host material are used to compute the Fourier transform. A comparison of experimental data for the system AlCu to the results of model calculations showed that the assumption of forces of equal magnitude on the 12 nearest neighbors alone is sufficient to describe the κ-dependence of the scattering cross section. A more complicated case is encountered in the system AlMn. Here the best description of the measured data could be achieved by a model with extremely anisotropic forces. To investigate the distortion scattering in the Nb-H-system, deuterium has to be used as defect. Because of the high mobility of the defects in this system, the scattering is quasielastic. The intensity scattered by D in Nb was compared to that obtained from H in Nb in order to avoid difficulties arising from the integration range as well as from geometry effects. At the same time this procedure has the advantage of lowering the influence of the abnormal Debye–Waller-factor, which, in turn, was measured at several temperatures. (79 figures, 10 tables, 86 references) (SFL)

20386 (NP-20480(P8), pp 101-103) DAMAGE FUNCTION BASED ON THE FOCUSED REPLACEMENT COLLISION MODEL. Sakairi, H.; Yagi, E.; Koyama, A.; Hasiguti, R. R. Dec 1974.
In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

20387 (ORNL-5025, pp 225-228) HEAVY-ION-INDUCED RADIATION DAMAGE. Bloom, E. E.; Farrell, K.; Kenik, A. E.; Packan, N. H.; Saltmarsh, M. J. May 1975.
In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).
4-MeV nickel ions are being used to bombard materials to induce swelling and other radiation effects. The investigation method and objectives are discussed. (3 figs) (GHT)

20388 (ORNL-5025, pp 229-230) HELIUM INJECTION FOR PARTIAL SIMULATION OF CONTROLLED THERMONUCLEAR RESEARCH RADIATION EFFECTS. Wiffen, F. W.; Woods, J. W. May 1975.
In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).
The injection technique is to degrade an approximately 50-MeV ORIC alpha beam with a rotating energy degrader of continually variable thickness before it reaches the target, which is scanned to produce a nearly uniform He content. A He injection run was made on metal and alloy specimens. (DLC)

20389 INFLUENCE OF LITHIUM IMPURITIES ON THE CHARACTER OF RECOVERY OF ELECTRICAL RESISTANCE OF IRRADIATED ALUMINUM. Ali, R.; Martkoplishvili, G. S.; Naskidashvili, I. A. (Inst. of Physics, Tbilisi, USSR). Soobshch. Akad. Nauk Gruz. SSR; 77: No. 1, 49-52(Jan 1975). (In Russian).
The character of recovery of electrical resistance of an Al-Li alloy irradiated by fast neutrons was studied. The atoms of Li impurity were found to influence the process of annealing at temperatures above room temperature. It was determined that the diffusion of Li impurities takes place in the temperature range of 300-400°C. (2 figures) (auth)

20390 IMPLANTATION OF CARBON INTO THIN IRON FILMS. Vogel, F. L. Jr. (Univ. of Pennsylvania, Philadelphia). Thin Solid Films; 27: No. 2, 369-376(Jun 1975).
Polycrystalline iron films, 1000-Å thick, were implanted with carbon ions at 38 kV to an average concentration of 6 at.%. After implantation and subsequent annealing, lattice parameter and microstructural determinations were made with transmitted electrons. Immediately after implantation, the carbon is retained in supersaturated solid solution and the lattice type is transformed from the normal body-centered cubic of alpha iron to body-cen-

tered tetragonal with a c/a ratio of 1.6. After annealing above 330°C for several hours, the carbon precipitates from solid solution as a carbide phase and the c/a ratio is reduced. These results can be interpreted in terms of the formation and annealing of the metastable martensite constituent of the iron-carbon system. (auth)

20391 VERIFICATION OF A MODEL FOR IN-REACTOR CREEP TRANSIENTS IN ZIRCONIUM. MacEwen, S. R.; Fidleris, V. (Atomic Energy of Canada Ltd., Chalk River, Ontario). Philos. Mag.; 31: No. 5, 1149-1157(May 1975).

Time-dependent solutions to the rate equations describing the vacancy and interstitial concentrations in an irradiated metal have been used to predict the transients in the in-reactor creep rate of zirconium that would occur during reactor start-up or shut-down. It is predicted that both the application and removal of flux causes the in-reactor creep rate to exceed the steady-state rate. Experiments using a creep rig designed to be able to move in and out of the reactor core have shown that the flux enhancement of creep begins immediately and that the creep rate decreases continuously until steady state is reached. Similarly, the removal of flux causes the creep rate initially to increase before decreasing to a negligible value. The good agreement between theory and experiment gives strong support to a model of flux-enhanced climb plus glide for the in-reactor creep of zirconium. (auth)

20392 ORIGIN OF VACANCY LOOPS IN NEUTRON-IRRADIATED ALUMINIUM. Risbet, A.; Levy, V. (CEN de Saclay, Gif-sur-Yvette, France). Philos. Mag.; 31: No. 5, 975-983 (May 1975). (In French).

Many metals irradiated in the range of 0.3 to 0.5 T_M contain an appreciable number of vacancy loops. A study by transmission electron microscopy of pure and impure aluminium samples neutron-irradiated at 55°C shows that these loops are not due to vacancy precipitation but are formed by a debris mechanism associated with dislocation climb. (auth)

20393 EFFECT OF ION BOMBARDMENT ON THE STRAIN GAUGE FACTOR OF THIN GOLD FILMS. Robinson, G. R. (Cambridgeshire Coll. of Arts and Tech., Cambridge, Eng.); Stephens, K. G.; Wilson, I. H. Thin Solid Films; 27: No. 2, 251-262(Jun 1975).

Evaporated gold films of approximately 200 Å in thickness have been bombarded with argon ions to increase the sheet resistance by sputter etching to a maximum of 40 kΩ/□. The strain gauge coefficient of resistance γ (i.e., the fractional change in resistance per unit strain) was measured for films with a wide range of sheet resistance, and was found to be almost invariant with an average value of 2.6. This contrasts greatly with the published values of γ of up to 100 for thin island-structure evaporated films of similar sheet resistance. The temperature coefficient β of the strain gage factor was found to be similar in magnitude but opposite in sign to the temperature coefficient of resistance α, which was measured as $+12 \times 10^{4}$°C^{-1}. The measured values of γ, β and α agree well with the values calculated by assuming that the metallic conduction is modified by reduction of the electron mean free path. It is concluded that a connected metallic layer still exists even at very high values of sheet resistance. (auth)

20394 TEMPERATURE AND DOSE DEPENDENCE OF SWELLING OF AUSTENITIC STEELS IRRADIATED IN THE BR-5 REACTOR. Shcherbak, V. I.; Bykov, V. N.; Dmitriev, V. D.; Kostromin, L. G.; Ladygin, A. Ya.; Porollo, S. I. (Inst. of Physics and Power Engineering, Obninsk, USSR). J. Br. Nucl. Energy Soc.; 14: No. 2, 145-148(Apr 1975).

From conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, Ger. (3 Dec 1974).

Radiation-induced swelling of three austenitic steels used as structural materials in the BR-5 reactor carbide core are discussed. Transmission electron microscope studies were made, after irradiation at 430 to 590°C and doses of 4.3×10^{22} n/cm^2 on hexagonal tubes of 18Cr-9Ni-Ti and 18Cr-10Ni-Ti steels annealed in vacuum at 1000°C for 20 min and on fuel rod cladding of both these steels and also the alloy 16Cr-15Ni-3Mo-Nb heat treated under 950°C for 10 min in vacuum. Results are discussed in detail. The swelling depended upon both irradiation conditions and steel composition. Differences in behavior between tubes and fuel cladding were probably due to the influence of stress. Alloying with Mo and Nb and increasing the C content at similar Ti contents reduced swelling. It was concluded that swelling could be influenced by the use of alloying additions or by selecting the type of thermal treatment of ensure finely dispersed precipitates at high density. (UK)

20395 RADIATION EFFECTS ON MECHANICAL PROPERTIES AND MICROSTRUCTURE OF SOLUTION-TREATED AND COLD-WORKED 1X18H10T AND 0X16H15M3B. Vorobyev, A. N.; Bykov, V. N.; Dmitriev, V. D.; Shcherbak, V. I. (Inst. of Physics and Power Engineering, Obninsk, USSR). J. Br. Nucl. Energy Soc.; 14: No. 2, 149-155(Apr 1975).

From conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, Ger. (3 Dec 1974).

The effects of irradiation on the mechanical properties and the microstructure of two Cr-Ni stainless steels 18Cr-10Ni-Ti and 16Cr-15Ni-3Mo-Nb were studied, as a function of cold work and thermomechanical treatment (7 to 40% cold work plus annealing of 800°C for 1h). Irradiation was in BR-5 at 450 to 550°C to doses of $(2.6 \pm 0.2) \times 10^{21}$ n/cm^2 and $(1.2 \pm 0.2) \times 10^{22}$ n/cm^2. Thermal effects were examined at 550°C and tensile tests were carried out at 25 to 650°C. Electron transmission studies were also performed to determine swelling effects. Analysis of the results shows that the change in properties of the two steels under irradiation at 450 to 500°C is caused by both thermal and radiation effects. The level of thermal stability of the mechanical properties depends upon chemical composition, initial microstructure, and dose. Swelling in both alloys was reduced by cold work and thermomechanical treatment. (UK)

20396 IRRADIATION EFFECTS ON MECHANICAL PROPERTIES OF AN SMAW DEPOSITED TYPE 308 STAINLESS STEEL. Ward, A. L. (Westinghouse Hanford Co., Richland, WA). Weld. J. (N. Y.); 54: No. 8, 259s-264s(Aug 1975).

Pre- and post-irradiation tensile and creep-rupture tests have been conducted on a shielded metal-arc welding (SMAW)-deposited Type 308 stainless steel containing controlled residual elements (CRE) boron, phosphorus and titanium. Fast reactor (EBR-II) neutron irradiation produced changes in the mechanical properties which are broadly consistent with trends established in wrought austenitic stainless steels. However, some behavioral differences, both prior to and after irradiation, are noted: higher as-deposited yield strength, lower ductility, lower ability to strain harden and a lower irradiation damage accumulation rate in the CRE 308 weld metal. All of these differences can be associated with inherent differences in the microstructure and thermal-mechanical history between the weld deposited CRE 308 and the wrought Type 304 stainless steel. (auth)

20397 REGENERATION OF ELECTRIC RESISTANCE OF NIOBIUM AND TANTALUM AFTER ELECTRON IRRADIATION AT 4.5 K. Faber, K. Stuttgart; Univ. Stuttgart (1974). 206p. (In German). INIS.

Thesis.

Highly pure and doped niobium and tantalum foils (thickness 0.015-0.030 mm) were irradiated in the Kernforschungsanlage Juelich with 3 MeV electrons at 4.5°K. The samples were then put into a transport cryostat at helium temperature and transported to Stuttgart. Regeneration values were between 4.5 and 600°K. Activating energies, reaction classes, and dose constants were determined. The niobium and tantalum specimen produced by the investigators had a residual resistivity ratio of 6,000 to 10,000. Other specimen were doped with oxygen and nitrogen. It was shown that oxygen, nitrogen, hydrogen, and metallic impurities change the regeneration values considerably. Yet a study of these influences on the one hand and the use of highly pure metals on the other hand enabled the investigators to determine the regeneration behavior of interstitials in the lattice. (GE)

20398 OBSERVATION OF ANOMALOUSLY LARGE PORES IN NICKEL BOMBARDED BY CARBON IONS. Krotov, V. I.; Lebedev, S. Ya.; Bykov, V. N. Sov. At. Energy (Engl. Transl.); 37: No. 4, 1080-1081(Oct 1974).

Translated from At. Energ. (USSR); 37: No. 4, 343-344(Oct 1974).

Annealed Ni was bombarded by Ar or C ions at 70 keV and then thinned and examined under an electron microscope. No pores were observed if the specimen thickness was small enough (<500-800 Å for C ions, <150-200 Å for Ar ions). The max dimension of the pores (~2200 Å) is about double the calculated path length of C ions. In specimens irradiated by Ar ions, very high concentrations of pores ($\sim 10^{16}$-10^{17} cm^{-3}) are formed. (DLC)

20399 THE OPTICAL CONSTANTS FOR GERMANIUM EXCITED BY ELECTRON BEAMS. Barkow, U. Brunswick; Univ. Brunswick (1973). 93p. (In German). INIS.

Thesis.

Using electron beams of an energy of 30 keV and a power density of up to 300 W/cm^2, the concentration of the free charge carriers (electrons and defect electrons) of self-conducting germanium could be increased to values of about 10^{18} cm^{-3}. Through this "photoinjection" method, the effect of the increased concentration of the free charge carriers on the optical constants n and k could be experimentally shown and measured in the spectral region of 2-15 μm. (GE)

20400 THE DEFECTS PRODUCED BY ELECTRON IRRADIATION AND ANNEALED AT ABOUT 360K IN N-TYPE GERMANIUM. Fukuoka, N.; Saito, H. (Osaka Univ., Toyonaka (Japan). Coll. of General Education). Jap. J. Appl. Phys.; 13: No. 10, 1524-1532 (Oct 1974).

Annealing of the radiation-induced defect associated with the $E_c-0.2$eV level was studied through electrical measurements in the range 280-380°K. It was found that the level annealed in two stages, for the convenience they are nomenclatured as first and second stages. The first stage was observed only for samples containing group V impurities, and its step height as expressed in fraction unannealed increased with an increasing impurity concentration, and the activation energy was found to be dependent on the impurities. A model for the defect which is annealed in the first stage is proposed to be an association of group V impurity and a vacancy. The second stage of annealing was observed in all n-type samples regardless of the impurity. The step height of this stage increased with increasing fluence. The activation energy was obtained to be 0.93 eV for all samples. By assuming that the defect is divacancy, the experimental results can be explained. (auth)

20401 NEUTRON IRRADIATION EFFECTS ON SUPERCONDUCTING Nb-Ti WIRES FOR FUSION REACTOR. Tsubakihara, H.; Okada, T.; Suita, T. (Osaka Univ., Suita (Japan). Faculty of Engineering); Horiuchi, T.; Matsumoto, K. J. Nucl. Sci. Technol. (Tokyo); 11: No. 10, 452-458(Oct 1974).

A systematic study was carried out on Nb-Ti wire of two different kinds of metallurgical structure, to examine the effects of neutron irradiation on the critical density J_c. The samples used were Nb-47.6 at. % Ti (sample A) and Nb-59.8 at. % Ti (sample B), which were aged at 380°C for $0 \sim 10^4$ min and irradiated to 1.3×10^{18} n/cm^2 ($E_n > 0.1$ MeV). The sample temperature during the irradiation is believed to have been below 70°C. The values of J_c of both A and B aged up to 50 min were found to increase with irradiation. But when aged beyond 100 min, B had its value of J_c lowered by the irradiation. The presence of Ti enriched precipitates such as α and ω phases in the samples was surmised from the behavior shown by the critical temperature T_c. The T_c of A and B changed little by irradiation when aged not longer than 100 min, but with aging beyond 500 min, B showed a decrease in its value of T_c. This decrease indicates that the Ti concentration in the matrix may have increased through radiation-induced breakup of the above-mentioned precipitates, which, in turn, would have brought about the reduction observed in J_c upon irradiation. It is concluded that superconducting Nb-Ti wire with J_c enhanced by precipitation does not appear very resistant to neutron irradiation. This underlines the importance of the choice of superconducting materials to be used in fusion reactor magnets. (auth)

20402 EFFECT OF NEUTRON IRRADIATIONS ON SUPERCONDUCTING PROPERTIES OF A-15 COMPOUNDS UNDOPED AND DOPED WITH ^{10}B AND ^{235}U. Bauer, H. (Univ. of Giessen, Ger); Saur, E. J.; Scheitzer, D. G. J. Low Temp. Phys.; 19: No. 3-4, 171-187(May 1974).

The effect of lattice damage caused by room temperature irradiations with products of ^{10}B(n,alpha)^{7}Li reactions and ^{235}U fissions and with fast neutrons on transition curves, quenching curves, and lattice constants of Nb_3Sn, Nb_3Al, $Nb_3(Al,Ge)$, and V_3Si have been investigated. The critical currents in transverse magnetic fields could be increased up to more than one order of magnitude. For heavily irradiated samples drastically reduced values for the critical currents, the upper critical fields, and the transition temperatures were observed. The lattice constants were increased up to 0.5 percent by irradiation. (auth)

20403 ELECTRON EMISSION OF NEUTRALIZER FILAMENTS UNDER ION BOMBARDMENT. Bernardet, H.; Pelissier, A. (SODERN, Limeil-Brevannes, France). Acta Electron.; 17: No. 4, 445-454(Oct 1974). (In French).

Results are presented from a study of the electron emission of neutralizer filaments working under ion bombardment for use in a cesium contact ion thruster. Two types of filaments were tested: a filament of carburized thoriated tungsten and a filament of rhenium coated with a lanthanum hexaboride. The experimental results and theoretical predictions are compared. When used as neutralizers, these filaments have a lifetime of over 10,000 h, an identical power consumption (6 to 7 W) and satisfactory emitting properties. Contrary to the thoriated tungsten type filaments, the lanthanum boride filaments exhibit an electron emission which is insensitive to a temporary increase of the ion bombardment. (auth)

Other Materials

Refer also to abstracts 19282, 19345, 19356, 19357, 19585, 19679, 20250, 20292, and 21592.

20404 (AD/A-002814) INFLUENCE OF ELECTRON (1.5 MeV) AND PROTON (5 MeV) IRRADIATION ON THE ELECTRICAL, OPTICAL, AND PHOTOELECTRIC CHARACTERISTICS OF GALLIUM ARSENIDE. Krivov, M. A.; Brudnyi, V. N. Translated by C. T. Ostertag, Jr. from Radiats. Fiz. Nemetal. Krist.; 3: 16-21(1971). 11p. (FTD-HT-23-0037-75). NTIS $3.25.

The purpose of the present work is the study of the spectrum of radiation defects created by electrons (1.5 MeV) and protons (5 MeV) at temperatures close to 300°K. Their stability to annealing, and also the influence of an admixture of copper on the spectrum of the levels which develop after irradiation. The investigation used gallium arsenide of N- and P-types of conductivity with a carrier concentration of 5×10^{15} to 10^{18}/cc. (GRA)

20405 (BNL-20253) RADIATION INDUCED COLORING OF GLASSES MEASURED DURING AND AFTER ELECTRON IRRADIATION. Swyler, K. J.; Hardy, W. H. II; Levy, P. W. (Brookhaven National Lab., Upton, N. Y. (USA)). 1975. 13p. (CONF-750703-13). Dep. NTIS $4.00.

From IEEE annual conference on nuclear and space radiation effects; Arcata, California, USA (14 Jul 1975).

The growth of color centers during irradiation, and the decay after irradiation, were studied in two glasses using recently developed equipment for making optical absorption and luminescence measurements during and after electron irradiation. The glasses studied were NBS 710, a soda-lime silicate glass, and NBS 711, a lead silicate glass. Both glasses exhibit similar coloring characteristics. The radiation-induced absorption spectra consists of a weak gaussian shaped band in the visible, a stronger gaussian band in the ultraviolet, and a band edge "shift" which may be accurately approximated by a third gaussian band. For all absorption bands, the color center vs dose (or irradiation time) curves can be accurately resolved into two saturating exponential and one linear component. The decay curves obtained after the irradiation is terminated can be accurately expressed by three exponential components. Coloring and decay curves made at different dose rates indicate that the processes responsible for decay after irradiation and electron hole recombination during irradiation play important roles in determining the rate and extent of coloring. Results are qualitatively in agreement with some very simple kinetic treatments for color center formation. In some, but not all, respects the quantitative agreement is also good. Lastly, the results indicate that it is necessary to make measurements during irradiation to establish the formation kinetics of color centers that are unstable at the bombardment temperature. (auth)

20406 (CONF-750714-1) EFFECTS OF FAST-NEUTRON DAMAGE FROM 0 TO 42 x 10^{21} NEUTRONS/CM^2 ON THE PHYSICAL PROPERTIES OF NEAR-ISOTROPIC GRADES OF GRAPHITE. Cook, W. H.; Kennedy, C. R.; Eatherly, W. P. (Oak Ridge National Lab., Tenn. (USA)). 1975. 5p. Dep. NTIS $4.00.

From 12th biennial conference on carbon; Pittsburgh, Pennsylvania, USA (28 Jul 1975).

The characterization of property changes in various grades of near-isotropic, "binderless" grades of graphite as functions of fluence accumulated at 715°C from 0 to 42 x 10^{21} neutrons/cm^2 (E greater than 50 keV) was made. Generally, the average coefficients of thermal expansion (CTE) from 20 to 600°C and the room-temperature values for strengths, fracture strains, Young's moduli, shear moduli, and calculated figures of merit (FOM) for resistance to thermal shock all ultimately decreased with fluence. (auth)

20407 (FRNC-TH-537) CONTRIBUTION TO THE STUDY OF THE DEFECTS CREATED IN ALKALINE HALIDES BY HEAVY ION BOMBARDMENT: OBSERVATION AND PROPERTIES OF INTERACTION TUBES ASSOCIATED WITH PARTICLES. Thevenard, P. (Lyon-1 Univ., 69 (France)). 1974. vp. (In French). INIS.

Defects (colored centers) created in LiF, NaCl, KCl and KBr crystals by bombardment with ^{1}H, ^{2}H, ^{4}He, ^{7}Li, ^{16}O, ^{19}F, and ^{35}Cl ions of energy above 1 MeV per nucleon were studied. Defect creation in alkaline halides is bound up with the different particle energy loss mechanisms: ionization, collision of particles with lattice ions, implantation of particles. Another important factor is that the energy is dissipated inside a small volume surrounding the particle track: the interaction tube. Some comments on an example of defect creation (case of 28-MeV deuterons) are followed by a kinetic study of the creation of F centers and I centers (lithium interstitial) from which the characteristics of interaction tubes associated with particles may be defined. The effect of interaction tube overlapping on the creation and development of defects is discussed and a chapter is devoted to the study of colloidal defects, especially those at the end of the track and those linked to particle implantation. (FR)

20408 (FRNC-TH-563) NATURAL AND ^{60}Co γ RADIATION-INDUCED CONDUCTION OF SILVER-ACTIVATED METAPHOSPHATE GLASS. Velompanahy, A. (Toulouse-3 Univ., 31

(France)). 1975. 93p. (In French). Dep. NTIS (US Sales Only) $7.75.

Thesis.

A study was made of natural and ^{60}Co radiation-induced conductions in metaphosphate containing Ag_2O glasses. Measurements of resistivity were made (10^{12} ohms cm at 20°C) and values of natural conduction activation energy between 0, 80-0, 95 eV at $E = 10^4$ V/cm were obtained. Both quantities increase with the silver percentage in the samples. Induced current was measured as a function of electric field, dose rate, and temperature and the results analyzed according to the ROSE's theory of photoconductivity. (auth)

20409 (GERHTR-131) CHANGES IN DIMENSIONS, MODULUS OF ELASTICITY AND THERMAL CONDUCTIVITY DUE TO RE-GRAPHITIZATION CAUSED BY NEUTRON IRRADIATION. Delle, W. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Reaktorwerkstoffe und Heisse Zellen). 26 Apr 1974. Translation of a paper presented at spring meeting of the Carbon Working Party of the German Ceramics Society. 16p. Dep. NTIS $4.00.

Work performed under United States--German High Temperature Reactor Research Exchange Program.

In addition to the radiation damage, a radiation-induced graphitization (re-ordering of poorly ordered areas) occurs during neutron irradiation of graphite. The competing influence of both effects is discussed with a view to the changes of dimensions, of E-module, and of heat-conductivity. (GE)

20410 (ORNL-TM-4504) GRAPHITIZATION KINETICS OF FLUIDIZED-BED PYROLYTIC CARBONS. Beatty, R. L. (Oak Rdige National Lab., Tenn. (USA)). Aug 1975. 211p. Dep. NTIS $13.75.

Thesis. Submitted to Univ. of Washington, Seattle.

Graphitization of 12 fluidized-bed pyrocarbons was studied as a function of heat-treatment time and temperature (1350 to 3000°C) to investigate the effect of initial microstructure on the graphitization process. The term "graphitization" is defined to include any thermally induced structural change, whether or not any layer stacking order is attained. A broad range of CVD microstructures was prepared at temperatures from 1150 to 1900°C and various propylene and methane concentrations. The twelve carbons spanned a wide range of graphitizabilities, primarily as a function of deposition temperature. Hydrocarbon concentration was of much less importance except for deposition at 1900°C. Hydrogen content of the as-deposited carbons decreased with increasing temperature of deposition, and initial graphitization behavior of the low-temperature carbons appeared to be related to hydrogen content and evolution. Rates of change in the parameters varied widely throughout the range of heat-treatment times (HTt) and temperatures (HTT) for the different carbons showing differences between the more graphitizable or "soft" carbons from the nongraphitizing or "hard" carbons. DELTA H for nongraphitizing carbons was 175 +- 15 kcal below 1950°C, 240 +- 35 kcal at 1950 to 2700°C, and 330 +- 20 kcal above 2700°C. For graphitizing carbons deposited at 1150°C, values near 245 kcal were obtained from anti chi data for the HTT range 1350 to 1650°C, while densification data yielded values of about 160 kcal in the same range. The behaviors observed for graphitizable carbons above 2000°C are consistent with literature. Different kinetic behaviors below 2000°C were shown to be due to different initial microstructures as well as to different parameters measured. (DLC)

20411 (SAND-75-5309) ELECTRON MICROPROBE STUDY OF THE HOMOGENEITY OF SILICON-GERMANIUM ALLOYS. Chambers, W. F. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1975. 13p. (CONF-750652-1). Dep. NTIS $4.00.

From 8th international metallographic society conference; Minneapolis, Minnesota, USA (29 Jun 1975).

This study provided an important guide for the necessary materials process development for the thermoelectric generator elements for radioisotope batteries. The final process utilized the technique of vacuum hot-pressing reduced, chill-cast material for producing silicon-germanium ingots. Although this material was not as homogeneous as zone-leveled ingots, it was more dense (greater than 99 percent of theoretical) and was considerably easier, quicker, and cheaper to manufacture. Throughout the production of this material, electron microprobe homogeneity traverses were made on random samples to provide quality control. The availability of quantitative traces provided a means of measuring on an absolute basis the deviation from stoichiometry of any given alloy grain. In other applications, it was possible to use such traces to identify phases or to determine concentration gradients across phases. (auth)

20412 RECOMBINATION CENTRES AND TRAPS IN $ZnIn_2S_4$. Guzzi, M. (Instituto di Fisica, Milan); Baldini, G. J. Lumin.; 9: No. 6, 514-522(Jan 1975).

Luminescence intensity, phosphorescence decay, and thermoluminescence glow were measured for $ZnIn_2S_4$ and results compared with previous data. Superlinear luminescence is found and it is interpreted in terms of the presence of several recombination centers in this crystal. From the analysis of the phosphorescence decay and thermoluminescence glow, an exponential trap distribution is deduced with a slope of 70 meV/decade. (NL)

20413 GRUENEISEN PARAMETERS OF PYROLYTIC GRAPHITES. Benson, D. A.; Gauster, W. B. (Sandia Labs., Albuquerque, NM). Philos. Mag.; 31: No. 5, 1209-1222(May 1975).

Measurements of stress pulses induced in pyrolytic graphite samples by a pulsed electron beam and monitored by an optical interferometer technique are described. The method yields values of Grüneisen tensor components and longitudinal elastic wave speeds for the heated material. Results for a highly-aligned compression-annealed pyrolytic graphite are reported as well as measurements for two as-deposited pyrolytic graphites with broader distributions of crystallite angular orientations. The compression-annealed graphite results are the first direct Grueisen parameter measurements reported for a highly-ordered graphite material. These data are compared, where possible, with the results of other measurements. The preferred orientation model is used to predict properties of materials with various crystallite distributions by using single-crystal elastic constant and thermal data. Qualitative agreement is obtained between measured and calculated properties as a function of crystallite alignment. (auth)

20414 RADIATION DAMAGE IN THERMOLUMINESCENT LiF TLD-PHOSPHORS. Jain, V. K.; Kathuria, S. P.; Ganguly, A. K. J. Phys., C (London); 8: No. 13, 2191-2197(7 Jul 1975).

The thermoluminescence (TL) response to gamma rays of the most sensitive glow peaks in LiF (II to V) reaches a maximum and then decreases. The decrease in response is attributed to radiation damage. It is observed that even after the considerable reduction in the TL, which results from a heavy dose, the saturation exposure for these peaks remains the same. However, by redistributing the traps among the peaks by pre-annealing at 200°C for 23 hours, the saturation exposure can be altered. Since saturation exposure is indicative of the availability of trap centers, it is suggested that radiation damage in LiF is due to a decrease in the luminescence centers. This decrease could be due to the aggregation of simple luminescence centers into complex centers. The possibility of the M-center being one such center is discussed. (auth)

20415 POSITRON ANNIHILATION IN GAMMA IRRADIATED CRYSTALS. Ramasamy, P.; Nagarajan, T.; Devanathan, V. (Madras Univ.). J. Phys. Chem. Solids; 36: No. 9, 859-860 (Sep 1975).

The angular correlation between the two gamma-quanta arising from positron annihilation in untreated and gamma-irradiated alkali halides (NaCl, KBr) is reported. For low gamma irradiation the percentage of positrons annihilating with F-centre electrons is not very significant. When the F-center concentration is increased to as much as $1.5 \times 10^{17}/cm^3$, about 15% of positrons annihilate with F-center electrons. The angular correlation curve becomes progressively narrower with increase in F-center concentration. Positrons annihilating in gamma-irradiated crystals reduce the F-center considerably. The results of a systematic investigation on F-center bleaching by positron annihilation are reported. (auth)

20416 SENSITIZED DELAYED FLUORESCENCE IN NAPHTHALENE/ANTHRACENE MIXED CRYSTALS: CONCENTRATION AND TEMPERATURE DEPENDENCE. Port, H.; Bader, M.; Weber, G.; Wolf, H. C. (Stuttgart Univ. (TH) (F. R. Germany). Physikalisches Teilinstitut 3). Z. Naturforsch., A; 30: No. 3, 277-286(Mar 1975). (In German).

8 figs.; 4 tabs.; 13 refs.

The delayed fluorescence of naphthalene crystals doped with anthracene has been investigated for concentrations between 7×10^{-9} and 10^{-5} mol/mol in the temperature range 4.2 to 300°K. The concentration dependence of both the quantum ratio of host and guest emission and of the lifetime shows the effectivity of energy transfer by triplet excitons. It can be described quantitatively within the statistical hopping model, which includes the probability for an exciton to visit the same host molecules repetitively before becoming trapped. This incoherent energy transport becomes faster as the temperature is lowered. The exciton hopping time decreases monotonically from $t = 2 \times 10^{-10}$ at 300°K to $t = 8 \times 10^{-11}$ at 130°K. Below 100°K the delayed fluorescence is governed by competing trapping effects. (GE)

20417 FRACTURE-MECHANICAL DATA FOR ASSESSING THE STRENGTH PERFORMANCE OF PLASTICS. Goldbach, G. (Chemische Werke Huels, Marl/Recklinghausen (F. R. Ger-

many)). Kunststoffe.; 64: No. 9, 475-481 (Sep 1974). (In German). 11 figs.; 16 refs.

The significance of fracture-mechanical data is explained and compared with conventional failure criteria. As an example of conventional failure criteria, the yield stress and elongation at break of different polyolefins is examined as a function of rate of elongation. The most important fracture-mechanical constant is the tear strength, which is discussed in relation to the rate of elongation. (GE)

20418 KINETICS OF THE THERMOLUMINESCENCE OF LEAD SULPHATE: SAMARIUM. Beaven, H. J. J. Phys. Chem. Solids; 36: No. 9, 949-952(Sep 1975).

The kinetics of the phosphor system $PbSO_4$:Sm are shown to be of a type not previously reported. The pre-exponential factor in the second-order rate equation for each glow-curve component is constant during an isothermal decay, but each time the phosphor is annealed and re-irradiated the constant takes a different value determined by the radiation dose. Conventional equations are slightly modified to account for the experimental results and a new model is proposed. (auth)

20419 NEUTRON AND RAMAN STUDY OF THE LATTICE DYNAMICS OF DEUTERATED THIOUREA. McKenzie, D. R. (Sydney Univ.). J. Phys., C (London); 8: No. 13, 2003-2010 (7 Jul 1975).

The Raman-active modes of thiourea, $SC(NH_2)_2$, and deuterated thiourea, $SC(ND_2)_2$, have been studied as a function of temperature and comparison is made with results of previous work. Neutron scattering results, obtained from a single crystal of $SC(ND_2)_2$ using a triple-axis spectrometer, include dispersion curves for acoustic modes propagating along the a^*, b^* and c^* directions together with parts of optic branches. The measurements have been made mainly in phase V, with some results in phase I. The elastic constants obtained from the acoustic mode dispersion curves are compared with values obtained by Brillouin scattering. (auth)

20420 ENHANCEMENT OF F-CENTRE COLOURATION DURING PLASTIC DEFORMATION OF ALKALI HALIDES. Boni, M.; Camagni, P.; Giani, E. (European Organization for Nuclear Research, Ispra, Italy). J. Phys. Chem. Solids; 36: No. 9, 883-891 (Sep 1975).

Stimulated growth of F-centers was observed by irradiating with x-rays alkali-halide single crystals during uniaxial deformation at controlled rates. Quantitative monitoring of the phenomena was performed for pure KCl at −195°C as well as in the range from 23 to 106°C. Distinct forms for the kinetics of growth were obtained in the two regions. A correlation was also established between the growth of excess coloration and the evolution of stress, in the higher temperature range. The data on the kinetics, stress dependence and temperature dependence suggest that the production of excess F-centers arises from the radiolysis of vacancy-producing debris (possibly, dislocation dipoles) that are also effective agents of hardening. The process is limited by thermally activated annealing, with an activation energy appropriate for free-vacancy migrations. It is suggested that the limiting reaction is a recombination of the excess negative-ion vacancies with an antimorph defect, contained in a complementary type of dislocation debris. (auth)

20421 DOSE DEPENDENCE OF SILICON AMORPHIZATION BY ION IMPLANTATION. Mueller, H. Munich; Univ. Munich (1973). 149p. (In German). INIS.

Thesis.

The amorphization of monocrystalline silicon by ion implantation was studied. For the theoretical description of the formation of an amorphous layer by the interaction with particles of different mass a model is proposed, in which the energy transformed to the target is a measure for the produced dislocations. Influences or the formation of an amorphous layer like healing procedures during or after implantation, dose rate, dose dependence of the number of produced dislocations and effective dislocation energy are discussed in connection with the experimental results. (GE)

20422 EFFECTS OF GAMMA RADIATION ON STRESS RELAXATION OF VULCANIZED RUBBERS UNDER LARGE DEFORMATION. Kusano, T.; Sutoh, Y.; Murakami, K. (Tohoku Univ., Sendai (Japan). Chemical Research Inst. of Non-Aqueous Solutions). Tohoku Daigaku Hisuiyoeki Kagaku Kenkyusho Hokoku; 24: No. 1, 25-36(Aug 1974). (In Japanese).

Natural rubber vulcanizates which were deformed to variable strains were exposed to γ rays, and their chemorheological properties were examined by the stress relaxation measurements in nitrogen atmosphere. The rate of relaxation decreased with increase in the extension ratios. The rate of degradation caused by peroxyradicals produced in the presence of oxygen was too fast to observe the effects of extension ratios. The relation between the rate of degradation and the extension ratios was represented by a straight line, and the slope of the straight line changes with the crosslinking density. It is suggested that the decrease of the rate of degradation in high extension rations is not caused by the crystallization, but is mainly caused by the orientation of polymer chains. Crosslinking reaction increases in proportion as its strain increases. Therefore, the materials increase in crosslinking density than the initial density. And stress relaxation occurs slowly in large deformation. (JA)

20423 STUDIES ON IRRADIATION RESISTING PAINTS FOR CONCRETE STRUCTURES IN NUCLEAR POWER PLANT. III. Kita, D.; Sumino, M. (Obayashi-gumi K. K., Tokyo (Japan)). Obayashi-Gumi Gijutsu Kenkyusho-Ho; No. 9, 122-127(Aug 1974). (In Japanese).

It is desirable for irradiation resisting paints used for concrete surface coatings to protect facilities in nuclear power plants from radioactive contamination to have low contaminability, high decontaminability, and radiation resistability. In order to investigate the influence of paint type, coating surface conditions, and γ radiation on the protective qualities of the paints, seven kinds of epoxy and phenolic paints were tested. Results showed that the decontaminability of a paint was not affected by γ radiation, but by the texture of the coating surface of the paint. The decontaminability was not related to radiation resistability, and stability in chemical solution under conditions of heat and pressure. A study was made on the thinking to be followed in selection of a paint. (JA)

20424 DEPTHS OF THE REGIONS DAMAGED BY PROTONS, DEUTERONS AND α-PARTICLES IN LITHIUM FLUORIDE SINGLE CRYSTAL. Kubo, Kazuko (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). J. Phys. Soc. Jap.; 36: No. 6, 1593-1596(Jun 1974).

The depths of regions damaged by 0.6 ~ 2.0 MeV protons, deuterons or α-particles penetrating the LiF single crystal were optically measured by utilizing the diffuse reflection of light from the metallic colloids formed by bombardment. The results were compared with the range-energy relations theoretically calculated on the Bethe formula. The depth data obtained agree well with the theoretical ranges with Z = 10 or 12, depending on the bombarding ions, not with Z = 6 which is usually taken for LiF. The rough approximation is given by the formulae with simple power of the energy value. As the sources of discrepancy between the depth of damaged region and the ion range, the following are possible: Channeling of the ions during penetration in the crystal and diffusion of the ion-induced defects. (auth)

20425 PRODUCTION OF COATINGS BY CURING WITH IONIZING RADIATION. Spoor, H.; Demmler, K. (to Badische Anilin- und Soda-Fabrik A. G. (BASF)). Canadian Patent 968,741. 3 Jun 1975. 11p.

The present invention relates to a process for the manufacture of coatings by applying ionizing radiation in doses of from 1-50 Mrad, to a composition which contains olefinically unsaturated, urethane group-containing polymeric materials having a molecular weight ranging from 1,000 to 20,000 and has been applied to a substrate. The polymeric materials, may be used in combination with olefinically unsaturated monomeric compounds, the proportion of monomer being from 10 to 200% by wieght of the urethane-containing polymer. (CA)

20426 ELECTRON MICROSCOPY AND DIFFRACTION IN SUPERCONDUCTORS OF COMPLEX CONSTITUTION. Moran, H. F.; Ohstuki, M.; Hibino, A.; Hough, C. Bol. Acad. Cienc. Fis., Mat. Nat., Caracas; 32: No. 94-95, 7-14(1972). (In Spanish).

Laminated complexes in which dichalcogenous transition metals were intercalated and which had superconducting properties were examined under a high resolution electron diffraction microscope. It was possible to resolve details of the crystalline lattice and of the imperfections of the lattice. The results can be correlated with the diffraction data, and with the chemical data, and confirm and extend the postulated models. (Elect. Electron. Abstr.)

20427 LATTICE VIBRATIONS IN DEUTERATED UREA. Lefebvre, J. (Villeneuve-d'Ascq, France); More, M.; Fouret, R.; Hennica, B.; Currat, R. J. Phys., C (London); No. 13, 2011-2021(7 Jul 1975).

Coherent inelastic neutron scattering was used to measure high-symmetry dispersion curves in deuterated urea. A twelve-parameter force constant model, allowing for atom-atom interactions between neighboring molecules as well as long-range dipolar forces, is presented in the rigid molecule, harmonic approximation. The model accounts for the measured external-mode Raman frequencies, diagonal elastic constants, and neutron results. On the basis of the model, LO-TO splittings for the polar external modes are calculated. (auth)

NUCLEAR MATERIALS AND WASTE MANAGEMENT

Accountability and Safeguards

Refer also to abstract 21693.

20428 (ERDA-7) SOCIETAL RISK APPROACH TO SAFEGUARDS DESIGN AND EVALUATION. Bennett, C. A.; Murphey, W. M.; Sherr, T. S. (Battelle Human Affairs Research Center, Seattle, Wash. (USA); National Bureau of Standards, Washington, D. C. (USA); Energy Research and Development Administration, Washington, D. C. (USA)). Jun 1975. 63p. Dep. NTIS $5.45.

There has been much discussion and public debate concerning the effectiveness of the national system of safeguards against malevolent acts involving nuclear materials. Useful dialogue on this subject has been hampered by the lack of well-defined objectives, system parameters and boundary conditions as a framework for communication. This study provides such a framework. Expressing the safeguards objective in terms of societal risk represents a change in focus, rather than intent, from the earlier view of safeguards as a system for protecting nuclear material against theft or diversion. The study defines both the safeguards problem and the safeguards system in terms that can be related to the general safeguards objective. It is axiomatic that the first step to an effective solution is a careful definition of the problem. The significant and immediate value of this study lies in the rigorous definition and systematic organization of recognized elements into a coherent and comprehensive pattern. Although the title specifically addresses design and evaluation, the framework provided by the study will be a useful management tool for safeguards implementation and administration as well. (auth)

20429 (SAND-75-0391) PHYSICAL SECURITY SYSTEM EFFECTIVENESS EVALUATION, A STATUS REPORT. Todd, J. L. Jr.; Nickell, W. C. (Sandia Labs., Albuquerque, N. Mex. (USA); Sandia Labs., Livermore, Calif. (USA)). Jul 1975. Contract AT(29-1)-789. 14p. (CONF-750608-12) Dep. NTIS $4.00.

From annual meeting of the institute of nuclear materials management; New Orleans, Louisiana, USA (18 Jun 1975).

A method to permit objective comparisons of physical security is under development and is expected to be useful in the optimization of system design and in cost benefit analysis. The procedure involves identifying the possible or potential characteristics of a postulated adversary, the countermeasures to deny or diminish adversary success, and the response capabilities of the defender. These, in conjunction with system definition information, are evaluated by the use of analytical models which provide a means of ranking systems against threats. This paper describes the status of this effort and includes an overview of the methodology with a brief description of various models being considered for use in effectiveness evaluation. (auth)

20430 (UCID-16808(Rev.1)) SYSTEMS ANALYSIS OF A SECURITY ALARM SYSTEM. Schiff, A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 28 May 1975. Contract W-7405-Eng-48. 34p. Dep. NTIS $4.00.

When the Lawrence Livermore Laboratory found that its security alarm system was causing more false alarms and maintenance costs than LLL felt was tolerable, a systems analysis was undertaken to determine what should be done about the situation. This report contains an analysis of security alarm systems in general and ends with a review of the existing Security Alarm Control Console (SACC) and recommendations for its improvement, growth and change. (auth)

20431 (Y-DJ-17186) NEW EMPHASIS ON MATERIAL ACCOUNTABILITY'S ROLE IN SPECIAL NUCLEAR MATERIALS SECURITY. Gambill, E. F. (Oak Ridge Y-12 Plant, Tenn. (USA)). Jun 1975. 5p. (CONF-750608-9). Dep. NTIS $4.00.

From annual meeting of the institute of nuclear materials management; New Orleans, Louisiana, USA (18 Jun 1975).

An evaluation of the Y-12 Plant SNM accountability system determined that some changes could be made to upgrade SNM security. A system has been devised to supplement regular monthly enriched uranium inventories with verification inventories of selected batches. The revised system will also permit emergency inventories within six hours. The system changes are primarily in data handling and will cost very little. (auth)

Disposal and Storage

Refer also to abstracts 19396, 19398, 19419, 19769, and 21770.

20432 (BNL-20032) SAVANNAH RIVER LABORATORY LONG-TERM WASTE STORAGE PROGRAM. Progress Report No. 9, Jan–Mar 1975. (Brookhaven National Lab., Upton, N. Y. (USA)). Apr 1975. 21p. Dep. NTIS $4.25.

The leachability of cement concrete composites incorporating SRL sludge #3 and Linde AW-500 zeolite was measured. Cesium release rates were found to be a function of the sludge to zeolite ratio of the composite. Compressive strength measurements were used to infer the thermal and radiation stability of a preliminary composite formulation with a 16:1 sludge to zeolite ratio. The small decreases in compressive strength found were not sufficient to compromise the integrity of the composite. The thermal conductivity of a preliminary composite formulation using a 16:1 sludge to zeolite ratio was measured at 60 and 100°C. (auth)

20433 RADIOACTIVE WASTES. Gutierrez Jodra, L. Energ. Nucl. (Madrid); 18: No. 91, 343-348(1974). (In Spanish).

The origin of radioactive wastes is outlined and the types of wastes are classified. The methods presently in use for the management and disposal of gaseous, liquid, and solid wastes are outlined. No adequate solution has yet been found for the storage of highly active wastes and various possible solutions are briefly indicated. (JSR)

20434 PRACTICAL APPLICATIONS OF THE REGULATIONS FOR LIQUID WASTE DISCHARGE. Hepp, H.; Fleischhauer, J.; Zietz, U. pp VP of VGB-Konferenz) Kraftwerke und Umwelt 1975. Essen; VGB Technische Vereinigung der Grosskraftwerksbetreiber e.v (1975). (In German)

From VGB-conference: Power plants and environment 1975; Essen, F. R. Germany (12 Mar 1975). 1 fig.; 1 tab.; 12 refs. With abstract.

The legal bases of the discharge of sewage (including radioactively contaminated sewage) from thermal power stations into surface waters or into public drainage systems are considered. The practice of official control is discussed. Sludge and waste disposal and discharge of used oils from oil and petrol separators are treated in connection with sewage treatment plants. The regulations for environmental statistics and the regulations for liquid waste discharge (in preparation) are mentioned, followed by a discussion of the water quality required in the discharged wastewaters (including radioactively contaminated sewage). Finally, the regulations for conventional and nuclear power plants are discussed, and one example is given for each. (Regulations for the discharge of radioactive materials into the waters, prepared by the LAWA task group (Laenderarbeitsgemeinschaft Wasser), December 1973.) (auth)

20435 SYSTEM FOR RADIOACTIVE LIQUID WASTES. (to Pielkenrood-Vinitex B. V.). Netherlands Patent 7,313,226/A/. 25 Sep 1973. 8p. (In Dutch).

A container and outlet pipe system for radioactive liquid wastes as occur in hospital laboratories, i.e., with low activity and short decay time, is described. The system can be connected to the existing sink and drain pipes and is equipped with a safety valve, sampling tap and dilution facility. More containers for storage during decay can be added to the system. (NL)

20436 WHAT THE PUBLIC DOESN'T KNOW ABOUT NUCLEAR WASTE MANAGEMENT: AN EXAMINATION OF HIGH-LEVEL WASTE MANAGEMENT AS AN ISSUE OF PUBLIC CONCERN. Larson, H. J. pp vp, 9p of Nuclear Controversy in the U.S.A. II. New York; Atomic Industrial Forum Inc. (1974).

From workshop on the nuclear controversy in the U.S.A.; Lucerne, Switzerland (5 May 1974). See CONF-740596-.

Factors contributing to a poor public understanding and acceptance of nuclear waste management techniques and options in the United States are listed and discussed. (MCG)

Handling Equipment and Procedures

20437 KRITIKALITAETSSICHERHEIT BEI DER HERSTELLUNG UND HANDHABUNG VON KERNBRENNSTOFFEN. Kritikalitaetsdaten fuer Uran 235-Dioxid-Leichtwasser-Mischungen. Entwurf. (Criticality Safety in Processing and Handling Fissile Materials. Criticality Data for Uranium 235 Dioxide Light Water Mixtures. Draft). Berlin, F. R. Germany; Beuth (Mar 1975). 6p. (In German). (DIN-25403B1. 4).

5 figs.; 2 tabs.

The proposed standard contains data and figures for an isolated system of a homogeneous uranium-235 dioxide light water mixture with maximum reflection by light water. (GE)

20438 KRITIKALITAETSSICHERHEIT BEI DER HERSTELLUNG UND HANDHABUNG VON KERNBRENNSTOFFEN. Kriti-

kalitaetsdaten fuer Plutonium 239-Dioxid-Leichtwasser-Mischungen. Entwurf. (Criticality Safety in Processing and Handling Fissile Materials. Criticality Data for Plutonium 239-Dioxide Lightwater-Mixtures. Draft). Berlin, F. R. Germany; Beuth (Mar 1975). 7 p. (In German). (DIN-25403 Bl. 5).

5 figs.; 3 tabs.

The proposed standard contains data and figures for an isolated system of a homogeneous plutonium 239 dioxide light water mixture with maximum reflection by light water. (GE)

20439 KRITIKALITAETSSICHERHEIT BEI DER HERSTELLUNG UND HANDHABUNG VON KERNBRENNSTOFFEN. Kritikalitaetsdaten fuer Plutonium 239-Nitrat-Leichtwasser-Mischungen. Entwurf. (Criticality Safety in Processing and Handling Fissile Materials. Criticality Data for Plutonium 239 Nitrate Light Water Mixtures. Draft). Berlin, F. R. Germany; Beuth (Mar 1975). 7p. (In German). (DIN-25403 Bl. 6).

5 figs.; 2 tabs.

The proposed standard contains data and figures for an isolated system of a homogeneous plutonium-239 nitrate light water mixture with maximum reflection by light water. (GE)

Transportation

20440 (DP-MS-74-58) DYNAMICS OF IMPACT IN DROP TESTS OF PACKAGING. Langhaar, J. W. (Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). 1975. 48p. (CONF-750411-7). Dep. NTIS $5.50.

From European nuclear conference; Paris, France (21 Apr 1975).

IAEA regulations require that packages containing more than a very small amount of radioactive or fissile material must withstand a drop from 9 m onto a target which is a flat, horizontal surface without escape of radioactive material, increase of external radiation level, and possible criticality. The troublesome mechanical aspects of demonstrating compliance with the drop test regulation are examined, and recommendations are made for further guidance from regulatory and standards organizations on the manner in which these aspects should be taken into account. (LCL)

20441 (SAND-75-0248) TRANSPORTATION ENVIRONMENT DATA BANK INDEX. Davidson, C. A.; Foley, J. T. (Sandia Labs., Albuquerque, N. Mex. (USA)). Jun 1975. Contract AT(29-1)-789. 37p. Dep. NTIS $4.00.

In an effort to determine the environment intensities to which shipping containers will be exposed, a "Data Bank" of environmental information has been established by Sandia Laboratories, Division 1542, for the ERDA Division of Waste Management and Transportation. This document is an index which can be used to request data of interest. (auth)

20442 SHIPPING CONTAINER FOR A BOTTLE OF RADIOACTIVE MATERIAL. Soldan, D. W. (to Mallinckrodt Chemical Works). US Patent 3,882,315. 6 May 1975. Filed date 12 Apr 1973. 6p.

A shipping container for a bottle of radioactive material comprises a can having a cavity therein for receiving the bottle, a screw cap for the can and the cavity, and an annular bottle retainer extending downwardly in the cavity from its upper end having an outwardly extending flange at its upper end clamped between the cap and the upper end of the cavity and an inwardly extending flange at its lower end receiving the neck of the bottle. The cap carries a sponge to absorb spillage from the bottle. (auth)

20443 SPENT NUCLEAR FUEL SHIPPING CASKS. Kasberg, A. H. (to Atlantic Richfield Co.). US Patent 3,888,794. 10 Jun 1975. Filed date 3 Oct 1973. 4p.

A UH_3-ductile metal cermet is used as a radiation shield in a shipping cask for spent nuclear fuel rods. (auth)

20444 METHOD OF MAKING SPENT NUCLEAR FUEL SHIPPING CASKS. Kasberg, A. H. (to Atlantic Richfield Co.). US Patent 3,878,275. 15 Apr 1975. Filed date 3 Oct 1973. 4p.

A UH_3-ductile metal cermet is used as a radiation shield in a shipping cask for spent nuclear fuel rods. (auth)

20445 SPENT FUEL SHIPPING CASK. Rollins, J. D.; Best, R. E.; Riggs, R. R.; Anderson, C. J.; Barnhart, V. J. (to Nuclear Fuel Services, Inc.). US Patent 3,886,368. 27 May 1975. Filed date 27 Feb 1973. 10p.

A shipping cask for spent or failed nuclear fuel assemblies is described. The cask has a generally cylindrical stainless steel enclosure with a thick stainless steel slab welded to one end, a thick stainless steel closure removably sealed to the other end, a sheath of lead surrounding the cylindrical wall, separate tanks for neutron absorbing liquid surrounding the lead sheath and balsa wood impact absorbers on the exterior of the cask. The cask is also provided with pressure relief and drain valves housed in cavities in the steel for protection and trunnions specially arranged to facilitate handling. (auth)

PARTICLE ACCELERATORS

20446 SCIENCE POLICY MAKING IN THE UNITED STATES AND THE BATAVIA ACCELERATOR. Jachim, A. G. Carbondale, IL; Southern Illinois University Press (1971). 214p. $8.95.

A sociological case study was made of the scientific community-government interactions resulting from the building of the Fermi National Accelerator Laboratory 200 BeV synchrotron at Batavia, Illinois. The investigation covers the time period from 1963 to 1967 and focuses on two related policy issues: the support of basic research and the redistribution of research and development (R and D) resources. During this interval, pressures were exerted on R and D policy makers, and the autonomy of the scientific community in this respect was strongly challenged. (PMA)

Design, Development, and Operation

Refer also to abstracts 20893 and 20904.

20447 (AECL-5032) PHYSICS DIVISION PROGRESS REPORT, OCTOBER 1 TO DECEMBER 31, 1974. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jan 1975. 95p. Dep. NTIS (US Sales Only) $7.75. AECL $2.00.

Operation of the MP tandem during the quarter is reviewed. Data handling means were improved, replacement coils of the quadrupole of the QD^3 spectrometer were installed, and emittance measurements needed for the design of the superconducting cyclotron were continued. Half-lives, branching ratios, and magnetic moments were measured, and a semiempirical method for estimating heavy-ion stopping powers in metal foils with improved accuracy was developed. An important advance in the description of collective motion within a truncated spherical shell model was achieved. Neutron scattering studies of liquid ^4He and $PrAl_2$ were carried out, and temperature effects in positron annihilation in Cu were investigated. A prototype apparatus to measure D_2O concentrations in water was constructed, and performance tests of high-purity Ge detectors were made. The heat conduction equation, three "bench-mark" loss-of-coolant problems, and a one-stage dynamic simulation of a Bruce heavy-water process tower were treated mathematically. (4 tables) (RWR)

For titles of individual papers see: 19808, 20297, 20380, 21126, 21177, 21192, 21227, 21245, and 21246.

20448 (ANL-8153, pp 90-95) ACCELERATOR DEVELOPMENT. Jan 1975.

In Chemistry Division annual report, July 1973-June 1974. (Argonne National Lab., Ill. (USA)).

Because the use of accelerated heavy ions would provide many opportunities for new and important studies in nuclear physics and nuclear chemistry, as well as other disciplines, both the Chemistry and Physics Divisions are supporting the development of a heavy-ion accelerator. The design of greatest current interest includes a tandem accelerator with a terminal voltage of approximately 25 MV injecting into a linear accelerator with rf superconducting resonators. This combined accelerator facility would be capable of accelerating ions of masses ranging over the entire periodic table to an energy corresponding to approximately 10 MeV/nucleon. This approach, as compared to other concepts, has the advantages of lower construction costs, lower operating power, 100 percent duty factor, and high beam quality (good energy resolution, good timing resolution, small beam size, and small beam divergence). The included sections describe the concept of the proposed heavy-ion accelerator, and the development program aiming at: (1) investigation of the individual questions concerning the superconducting accelerating resonators; (2) construction and testing of prototype accelerator systems; and (3) search for economical solutions to engineering problems. (auth)

20449 (INIS-mf-1661) PROGRESS REPORT, 1971, FOSTER RADIATION LABORATORY, DEPARTMENT OF PHYSICS, McGILL UNIVERSITY. (McGill Univ., Montreal, Quebec (Canada). Foster Radiation Lab.). [nd]. 26p. INIS.

The activities of the Foster Radiation Laboratory revolve around the synchrocyclotron, which in 1971 was used wholly as a means for radioisotope production. Developmental studies have been made on the external beam system, the ion source and the rf system, resulting in new construction in 1971 and planned for 1972. The experimental facilities have been improved by the addition of a PDP-15 computer and a target fabrication room. Twenty-two research projects were on-going during 1971, primarily studies of nuclear structure by means of beta, gamma, delayed proton and delayed alpha decays, and of the properties of nuclei lying far off the beta stability line. (auth)

20450 (KFK-2141) FEASIBILITY STUDY OF A POSTACCELERATOR FOR IONS OF MEDIUM MASS WITH SUPERCONDUCTING HELICALLY LOADED RESONATORS. Deitinghoff, H.; Klein, H.; Kuntze, M.; Vetter, J. E.; Jaeschke, E.; Repnow, R. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Experimentelle Kernphysik). Apr 1975. 36p. (In German). Dep. NTIS (US Sales Only) $5.00.

Postaccelerators enlarging the capabilities of electrostatic preaccelerators are of growing interest. High energy gain per unit length, maximum flexibility to accelerate different kinds of ions, and good beam quality are the specific features desired for heavy ion postaccelerators. These conditions can in principle be obtained using short superconducting rf-cavities, and $\lambda/2$ helically loaded resonators are proposed as accelerating elements. Design considerations are discussed and a tentative set of parameters is given for an accelerator capable of a final energy of 6 MeV/N up to mass 80. Recent results obtained for superconducting test resonators indicate that the design of an accelerator which fulfills the conditions given above is possible. In addition, this design offers the advantage of reduced power consumption compared to proposed machines with non-superconducting magnets. (auth)

20451 (NP-20479) TRIUMF ANNUAL REPORT, 1974. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility). Apr 1975. 79p. Dep. NTIS (US Sales Only) $7.25.

The experimental program is based on a cyclotron capable of accelerating two simultaneous beams of protons, individually variable in energy, from 180 to 500 MeV. The potential for high beam currents — 100 μA at 500 MeV to 300 μA at 400 MeV — qualified this machine as a meson factory. The first acceleration of protons at TRIUMF to the full design energy of 500 MeV is reported, and machine characteristics are discussed, including beam dynamics, magnet parameters, power supplies, the rf system, ion source and injection system, beam probes, and control systems. Experimental facilities such as targets, beam lines, and instrumentation are described. A list of proposed experiments is given, and the research program organization and finances are outlined. Fields of research include basic science, such as medium-energy nuclear physics and chemistry, as well as applied research, such as neutron activation analysis, isotope research and production. There is also a biomedical research facility which will use mesons in cancer research and treatment. (PMA)

20452 (RL-75-069) NIMROD OPERATION AND DEVELOPMENT. Quarterly Report, January 1-March 31, 1975. Gray, D. E. (ed.). (Science Research Council, Chilton (UK). Rutherford Lab.). Apr 1975. 14p. Dep. NTIS (US Sales Only) $4.00.

The Nimrod beam was on for High Energy Physics Research for 93.65% of HEP scheduled operating time. One experiment commenced, one was completed and three continued through. Some details of the new beam complex, currently being constructed in Experimental Hall 1, are given. (auth)

20453 DOWNTIME EXPERIENCE FOR CLINICAL LINEAR ACCELERATORS. Bjarngard, B. E.; McEwen, D. A. (Harvard Medical School, Boston). Med. Phys.; 1: No. 2, 77-78(1974).

The downtime for four linear accelerators in clinical radiation therapy was studied for about four years. The time lost during patient treatment hours is on the average 3 percent with an in-house technical service group, which invests approximately 1000 man-hours per machine per year in preventive maintenance and repair. The time lost decreases significantly with time after installation. (auth)

20454 POSSIBILITIES OF USE OF AN ACCELERATOR FOR CARRYING OUT MICROANALYSES BY MEANS OF NUCLEAR REACTIONS OR ELASTIC SCATTERING. Caruso, E.; Sona, P. G. (CISE, Milan). Energ. Nucl. (Milan); 22: No. 2, 78-84(Feb 1975). (In Italian).

The main characteristics are described of two relatively recent techniques of microanalysis using particle accelerators for nuclear reactions or elastic scattering experiments. These techniques could also be of interest for the 7 MeV tandem Van de Graaff accelerator of CISE. A review is given of the relevant experimental results recently published, and a comparison is made of these techniques with several more conventional methods. (auth)

Auxiliaries and Components

Refer also to abstracts 20448, 20450, 20451, and 21364.

20455 (CEA-CONF-3063) SUPERCONDUCTING PULSED DIPOLE "ALEC". Bronca, G.; Boissier, R.; Dubois, P.; Ferry, J.; Maldy, J.; Perot, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. du Synchrotron Saturne). 21 Apr 1975. 5p. (CONF-750438-5). Dep. NTIS (US Sales Only) $4.00.

From 5th international conference on magnet technology; Frascati, Italy (21 Apr 1975).

The design and construction of the synchrotron pulsed dipole "ALEC" are described (5 T, 1.5 m long, 0.1 Hz frequency). The magnet was built in a factory using industrial techniques. A precision winding technique was developed which assures accurate placement of the turns. The iron core is laminated and designed so that it matches axial coil thermal contraction. The coils are assembled into the iron core, which is unsplit, in such a way as to accommodate the differential thermal contraction in the radial direction. Results of first tests of the magnet are given. (auth)

20456 (IEA-28) DESIGN OF AN IRRADIATION CHAMBER FOR AN INDUSTRIAL ELECTRON ACCELERATOR AT 1.5 MeV AND 25 mA. Castagnet, A. G. C.; Szulak, C.; Nakahira, S. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Mar 1974. 22p. (In Portuguese). Dep. NTIS (US Sales Only) $4.25.

A preliminary description is given of an irradiation chamber intended to hold an industrial electron accelerator "Dynamitron" of 1.5 MeV and 25 mA. The facility was designed for the various irradiation process already established and for the development of new processes, including treatment of materials with various sample sizes and shapes. The method adopted for calculating the shielding, under the assumption that accelerator will be used to produce x-rays for a high intensity source of electromagnetic radiation, is also described. (auth)

20457 (LA-5954) 100-MHz POWER AMPLIFIER DESIGN AND CONTROL FOR A HEAVY-ION ACCELERATOR. Lunsford, J. S.; Shipley, J. P.; Sutton, J. (Los Alamos Scientific Lab., N. Mex. (USA)). Jul 1975. 11p. Dep. NTIS $4.00.

Design details are given for a typical power amplifier and its control systems to be used for the approximately 80 spiral resonating cavities of the proposed heavy-ion accelerator at Los Alamos Scientific Laboratory. Operational procedures and some experimental results are also described. Plate circuit design is important for maximum efficiency and stability. The original movable-short, fixed-tap design was not optimal, and several improvements are described. Perturbation controllers are required for the cavity rf phase, amplitude, and resonant frequency. The amplitude control is done by varying the power amplifier screen-grid voltage. Typical power amplifier output is 20 kW at 33 percent plate efficiency and 19-dB gain. (auth)

20458 (NIIEFA-B-0189) BENDING MAGNET POLE. Suvorov, M. M. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1973. 10p. (In Russian). INIS.

The poles of electromagnets tend to cause local saturation of the material at the nodes. This behavior leads to changes in the magnetic field spacial distribution in the gap of the electromagnet and creates improved homogeneity with increasing induction. This study considers a pole with a side surface of special form, where these phenomena are absent. (SJR)

20459 (RL-75-066) NEW DEVELOPMENTS IN THE MAGNET DESIGN COMPUTER PROGRAM GFUN. Armstrong, A. G. A. M.; Collie, C. J.; Diserens, N. J.; Newman, M. J.; Simkin, J.; Trowbridge, C. W. (Science Research Council, Chilton (UK). Rutherford Lab.). Mar 1975. 16p. Dep. NTIS (US Sales Only) $4.00.

Several major improvements were introduced in the GFUN system for designing magnets which have extended the scope and power of the three dimensional program. In this system, the contribution to the magnetic field for conductor regions is determined by direct integration, thus enabling the contribution from the non-linear iron regions to be expressed as the solution of an integral equation. For this purpose the iron is subdivided into a large number of triangular prisms. The improvements include: (1) a number of new conductor geometries suitable for saddle coil and more conventional windings; (2) an increase in the practical limit of the number of elements which can be used to represent saturable iron; and (3) the extension to higher order symmetries, both multipole and rotational, thus achieving economies in the number of elements that have to be specified. The introduction of backing store methods for the solution of the large set of algebraic equations required in the magnetization computation resulted in a more efficient use of the computer. Higher level facilities, such as particle tracking and computation of field integrals, were implemented to aid in the solution of particular problems. Several comparisons of calculated fields with measurements are given, including a detailed study of the Harwell Variable Energy Cyclotron. (auth)

20460 (TRI-PP-75-2) ACCELERATING VOLTAGE CONTROL AND STABILIZATION IN THE TRIUMF CYCLOTRON. Gummer, R. H. M. (British Columbia Univ., Vancouver (Canada). Faculty of Medicine). Mar 1975. 4p. (CONF-750335-67). Dep. NTIS $4.00.

From particle accelerator conference; Washington, District of Columbia, USA (12 Mar 1975).

The basic rf system of the TRIUMF cyclotron consists of a resonant accelerating electrode structure powered at 23.05 MHz by a 1.8 MW transmitter. The prime objective of the rf control system is to ensure an accelerating voltage of stable amplitude and frequency. Through the extensive use of feedback loops and fixed-program logic circuits, the problems of multipactoring, resonator detuning, rf voltage breakdown, and rf voltage disturbances are dealt with. The system is almost completely automatic, so that straightforward operation of the rf system, via a CAMAC link, from the main cyclotron control desk is achieved. (auth)

20461 (TRI-PP-75-3) TRIUMF RF SYSTEM. Poirier, R. L.; Zach, M. (British Columbia Univ., Vancouver (Canada). Faculty of Medicine). Mar 1975. 4p. (CONF-750335-68). Dep. NTIS $4.00.

From particle accelerator conference; Washington, District of Columbia, USA (12 Mar 1975).

The design concepts of the TRIUMF resonator structure are described, and its development from models to final installation in the vacuum chamber is traced. The 1.8 MW transmitter and transmission line are described briefly. Problems encountered in testing and commissioning the rf system are discussed, and a summary of rf system performance over the first two months of cyclotron operation is given. (auth)

20462 (TRI-PP-75-5) INITIAL OPERATING EXPERIENCE WITH THE TRIUMF 300 keV H^- INJECTION SYSTEM. Beveridge, J.; Blackmore, E. W.; Bosman, P. F.; Dutto, G.; Joho, W.; Riches, R. D.; Rodel, V.; Root, L. W.; White, B. L. (British Columbia Univ., Vancouver (Canada). Faculty of Medicine). Mar 1975. 4p. (CONF-750335-70). Dep. NTIS $4.00.

From particle accelerator conference; Washington, District of Columbia, USA (12 Mar 1975).

The present TRIUMF injection system consists of a 12 keV Ehlers type unpolarized H^- ion source, located in a 288 keV accelerator terminal and connected to the cyclotron by a 35 m long injection line which contains two 90° electrostatic bends, three periodic quadrupole sections, and elements to pulse, bunch, and chop the beam. The stray magnetic field from the cyclotron was compensated for in the source and along the beam line with passive shielding and ferrite permanent dipoles. The beam enters the cyclotron axially and is bent into the median plane by means of a spiral inflector. This system is now being commissioned, and currents of 50 μA dc and 250 μA peak in a pulsed mode have been obtained with 90% transmission. Currents of 500 μA dc and a bunched beam of 1.5 mA peak have been obtained previously in the prototype injection system, and similar performance can be expected with the present system. A polarized H^- source is under construction. (auth)

20463 SUPERCONDUCTING MAGNETS: A POST-FRASCATI REVIEW. CERN Cour.; 15: No.5, 147-154(May 1975).

Superconducting magnet applications in high-energy physics are reviewed in the light of developments presented at the Fifth International Conference on Magnet Technology (April 21-25, 1975). Topics include: (1) magnets for bubble chambers; (2) magnets for spectrometers; (3) special magnets in detection systems; (4) magnets for beam-lines; (5) magnets for polarized proton targets; (6) pulsed magnets; and (7) superconducting materials. Applications in other fields (motors, trains, and energy storage) and the role of high-energy physics in advancing magnet technology are also discussed. (PMA)

20464 SUPERCONDUCTING CYCLOTRON. Bigham, C. B.; Schneider, H. R. (To Atomic Energy of Canada Ltd.). Canadian Patent 966,893. 29 Apr 1975. 12p.

An isochronous cyclotron was designed which uses an air core superconducting magnet system to provide high intensity magnetic fields. To provide an axial focusing field, iron sectors, with spiral edges acting as flutter poles, are positioned in the magnetic field such that saturation of the iron in the sectors gives an increased field between the sectors and a slightly decreased field outside. (auth)

20465 ACTIVATION OF ALUMINIUM BEAM DUMPS BY HIGH-ENERGY ELECTRONS AT SLAC. Swanson, W. P. (Stan-

ford Linear Accelerator Center, CA). Health Phys.; 28: No. 5, 495-502(May 1975).

Water-cooled Al beam dumps are used at SLAC to absorb the energy of high-intensity electron beams through development of a massive electromagnetic cascade. The aluminum becomes activated and constitutes a moderate radiation hazard. Decay-curve measurements made near two such dump installations are presented and compared with calculation. The most important radionuclides produced in the Al are identified as $^{24}Na(T_{\frac{1}{2}} = 14.96$ h) and $^{22}Na(T_{\frac{1}{2}} = 2.62$ y). It is found that other activated materials, particularly Fe shielding, can increase the exposure rates near such installations significantly, and must be considered. A formula is given which is useful for predicting dose rates for operational health physics use. Recommendations are made with a view to reducing doses to personnel who must work in the vicinity of such installations. (auth)

Ion Sources and Injection and Extraction Systems

Refer also to abstracts 20451 and 21053.

20466 (FRNC-TH-514) PARTICLE BUNCHING IN AN INJECTOR INTENDED FOR HIGH ELECTRON LINEAR ACCELERATORS. Tronc, D. P. (Paris-11 Univ., 91- Orsay (France)). 1973. 266p. (In French). INIS.

This work was to study and improve processes of particle cloud or packet formation at the start of acceleration from a continuous beam emitted by a source. It concerns linear electron accelerators only. The problem was both to cause a bunching in packets following one another periodically from an initially continuous beam and to accelerate these packets correctly so that the state where the component particles are ultra-relativistic was reached as quickly as possible. The methods and algorithms used to calculate the particle dynamics are described. It was necessary to call on a computer since analytical approaches are limited by the evolutive nature of the dynamic phenomenon studied and by inter-particle repulsion phenomena. The study of bunching calculated by the above means was centered on conventional or "natural" bunching, for which the particles synchronise with the accelerating field; on pre-bunching, on the use of a "long" cavity where the particle phase with respect to the field varies rapidly; and on working characteristics apart from the nominal values of the parameters. The practical problems involved in the building of injector components and the methods used for their sizing are studied. Existing and planned injector systems are analyzed (very high current injector, simple stationary-wave injector and American type high injection voltage injector). (FR)

20467 (IFVE-OP-73-9) METHODS FOR TUNING RF-SEPARATED BEAMS. Bernard, P.; Vishnevskaya, A. M.; Galyaev, N. A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 39p. INIS.

A description is given of a channel of separated particles of high energies for the bubble chamber "Mirabel" on the IFVE accelerator. Methods of tuning the beam and the equipment which is used are discussed. (SJR)

20468 (NP-20480(P8), pp 84-88) PERFORMANCE OF THE IPCR POLARIZED ION SOURCE. Motonaga, S.; Fujisawa, T.; Hemmi, M.; Takebe, H.; Ikegami, K.; Yamazaki, Y. Dec 1974.

In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

20469 (NP-20480(P8), pp 89-92) INVESTIGATION OF RESIDUAL GASES IN THE IONIZER OF POLARIZED ION SOURCE. Ikegami, K.; Takebe, H. Dec 1974.

In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

20470 (NP-20480(P8), pp 93-96) MECHANICAL DESIGN OF A POLARIZED ION SOURCE FOR THE INS CYCLOTRON. Takeshita, I. Dec 1974.

In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

20471 PROPOSED HIGH-CURRENT NANOSECOND SOURCE OF ENERGETIC IONS. Nation, J. A. (Cornell Univ., Ithaca, NY) J. Plasma Phys.; 13: 361-366(Apr 1975).

An ion source for a high-current ion accelerator is proposed. The source also provides an intense electron beam propagating in the same direction as the proton beam. With a 700 keV E beam, the ions receive about 6% of the total E beam energy. The generation of such intense ion beams is also of substantial interest in its own right, having applications in nuclear, plasma and radiation physics. (auth)

20472 COLLECTIVE ION ACCELERATION MECHANISMS INVOLVING DRIFTING INTENSE RELATIVISTIC ELECTRON BEAMS. Olson, C. L. (Sandia Labs., Albuquerque, NM). Part. Accel.; 6: No. 2, 107-122(1975).

Several possible mechanisms of collective ion acceleration, involving intense relativistic electron beams injected into low pressure neutral gases, are examined in depth. A brief summary of existing experimental data is given. Possible acceleration mechanisms are categorized as to how the main accelerating electric field is created. These categories include electrostatic space charge fields, induced fields, and collective wave fields. Six existing theories of ion acceleration are examined, including four potential well models, a localized magnetic pinch model, and an inverse Cherenkov radiation model. Each theory is summarized, compared with the data, and commented upon in regard to its validity and applicability. It is concluded that the mechanism responsible for the observed acceleration must be an electrostatic type effect, but that a new theory is needed to explain the existing data with all of their parametric dependences. (66 references) (auth)

Ion Optics and Field Calculations

20473 (AD-778800) INVESTIGATION OF THE ACCELERATION OF IONS BY INTENSE ELECTRON FLUXES. Replaov, N. S.; Khizhnyak, N. A.; Plyutto, A. A.; Lysneko, O. E. 8 Apr 1974. Translated by F. C. Vaughn from pp 100-101 of Simpozium po Kollektivnym Metodam Uskoreniya, Dubna, 27-30 September 1972. (CONF-720952-12; FTD-HT-23-1326-74). 6p. NTIS $3.00.

From symposium on collective methods of acceleration; Dubna, USSR (27 Sep 1972).

A simple theoretical model of the acceleration of ions by intense electron fluxes emerging from plasma is proposed. (GRA)

20474 (TRI-PP-75-4) COMA: A LINEAR MOTION CODE FOR CYCLOTRONS. Kost, C. J.; Mackenzie, G. H. (British Columbia Univ., Vancouver (Canada). Faculty of Medicine). Mar 1975. 4p. (CONF-750335-69). Dep. NTIS $4.00.

From particle accelerator conference; Washington, District of Columbia, USA (12 Mar 1975).

COMA, a computer program written in FORTRAN IV, accurately calculates the relative motion of up to 5000 particles over the complete energy range of the TRIUMF cyclotron at a cost about 1% of our numerical integration codes. In addition, it can simulate the action of diagnostic probes and slits. COMA uses linear transformation matrices, obtained from an equilibrium orbit code, that include coupling between radial and longitudinal motion. The energy gain and vertical focusing forces at the dee gap are given by an improved analytical model. (auth)

20475 EQUILIBRIA OF INTENSE, PARTIALLY NEUTRALIZED, RELATIVISTIC PARTICLE RINGS IN ANNULAR VACUUM CHAMBERS. Gratreau, P. (CNEN, Frascati, Italy). Part. Accel.; 6: No. 2, 67-76(1975).

The analysis of the equilibrium of a relativistic high intensity particle beam circulating in an annular chamber is developed in the Vlasov framework. A relative space-charge limit is established. The characteristics of the vacuum chamber and of the coil are determined, in a particular solution, from the asymptotic expansions of the potentials in the vicinity of the magnetic axis. (auth)

20476 KINETIC INSTABILITY OF AN INTENSE BEAM OF CHARGED PARTICLES IN A STORAGE RING. Naugol'nyi, N. N. Sov. At. Energy (Engl. Transl.); 37: No. 4, 1082-1084(Oct 1974).

Translated from At. Energ. (USSR); 37: No. 4, 344-346(Oct 1974).

The so-called "negative mass" instability (NMI) of a beam in a smooth nonresonant perfectly conducting cavity was studied. The results show that as the ring current increases, a kinetic instability of the beam, rather than a hydrodynamic NMI, develops. A kinetic instability can appear earlier than the NMI, since an appreciable threshold current is generally required for the development of an NMI due to the thermal spread in momenta. (auth)

20477 DEPTH REGULATION OF ELECTRON ENERGY AT THE EXIT OF A LINEAR ACCELERATOR. Bekhtev, B. V.; Shchedrin, I. S. (Moscow Engineering-Physics Inst.). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 2, 128-129(1975). (In Russian).

This problem can be solved by using a grouping section in which the form of the oscillations varies along the length at a nominal frequency from $\pi/2$ in the first cells to $\pi/3$ in the latter cells. The depth of tuning (according to electron velocity) is increased a factor of 1.5 without a noticeable increase of damping in the initial section. Design parameters include the distribution of the

electric field axial components and the phase velocity along the length of the grouping section. By a small change in the power of the high-frequency feed, it is possible to regulate over wide limits the spectral characteristics of the beam at the accelerator exit. (8JR)

20478 PARTICLE MOTION IN TRAVELING WAVE UNDER SIMULTANEOUS RADIAL AND PHASE STABILITIES. Zaidin, D. G. (Radiotekhnicheskij Inst., Moscow). Part. Accel.; 6: No. 3, 183-190(Jun 1975).

Expressions are obtained that describe particle acceleration in a traveling wave with a longitudinally varying amplitude ensuring simultaneous radial and phase stabilities (simultaneous self-phasing and self-focusing). The possibility of obtaining a rather wide trapping region at a small synchronous phase, the absence of a closed separatrix in the longitudinal phase-space plane, and the existence of stable synchronous phases at the descending wave slope in addition to those at the ascending one are pointed out. (auth)

20479 CROSSING THE PHASE TRANSITION IN STRONG-FOCUSING PROTON SYNCHROTRONS. Soerenssen, A. (European Organization for Nuclear Research, Geneva). Part. Accel.; 6: No. 3, 141-173(Jun 1975).

Two effects are observed when a high-intensity bunch crosses the phase transition: bunch-length oscillations are excited, and there is also a sudden increase of the longitudinal emittance. For some accelerators, these effects may be an intensity limitation as important as the transverse space-charge forces, and their nature is well understood. The emittance increase is less well understood, the most important mechanism probably being the negative-mass instability which develops right after transition, although other mechanisms play a certain role. Various cures exist to counteract these mechanisms; the most successful one is the so-called $\gamma_{transition}$-jump, where the transition energy is rapidly reduced by pulsing a suitable set of quadrupoles. The various mechanisms and cures are discussed in qualitative terms, the theory is developed, and the present state of knowledge is discussed. (auth)

20480 SOME ASPECTS OF SIMULTANEOUS ACCELERATION OF PROTON AND H^- BEAMS IN A LINAC. Murin, B. P.; Bondarev, B. I.; Durkin, A. P.; Lomize, L. G.; Soloviev, L. Yu.; Fedotov, A. P. Part. Accel.; 6: No. 3, 133-139(Jun 1975).

When both protons and negative ions are accelerated in the same linac at the same time, new problems arise concerning suppression of beam coherent and incoherent oscillations caused by errors in doublet adjustment. Although the main parameters of the focusing channel do not vary if the sign of particle charge is reversed, the individual beam trajectories of protons and negative ions are different. New techniques for beam position control are suggested, and their efficiency is evaluated using a computer model. It is shown that a transverse artificial displacement of doublet axes can be used as a rather efficient means to shift the positive and the negative beam in the same direction. Such axis displacements of two successive doublets, combined with axis displacement of individual lenses in each of these doublets, all produced electrically, make it possible to place the positive and negative beams at any required point in the transverse phase-space plane. Beam axial alignment appeared much less efficient than might be desired for suppressing beam oscillations. Production of new beam oscillations with the phases and amplitudes properly chosen is shown to be more efficient than beam alignment along the linac axis. A global control of focusing field throughout the linac is briefly discussed as a possible method to reduce oscillations through off-resonance tuning. (auth)

Storage Rings

Refer also to abstract 20459.

20481 (DEU-75-3) PETRA: A MODEL FOR THE EXTENSION OF THE DESY STORAGE RINGS TO HIGH ENERGY. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F.R. Germany); Zentralstelle fuer Atomkernenergie-Dokumentation, Leopoldshafen (F.R. Germany)). Nov 1974. 128p. (In German). INIS.

With figs., tabs. and refs.

A detailed proposal for the extension of the storage ring devices at DESY up to energies of 19 and 23 GeV is given. The physics to be done is discussed as electron-positron-annihilation, photon-photon-reactions, search for new particles, and proof of quantum electrodynamics. The storage ring with beam optics and magnet structures, HF- and vacuum system and schedule and costs are described. (GE)

20482 HIGH ENERGY PHYSICS FILE 6. Britain's Future Is EPIC. Venus, W. (Science Research Council, Chilton, Eng.). New Sci. (London).; 66: No. 948, 322-325(8 May 1975).

The experimental future of high energy physics depends on the building of new accelerators, but the new generation of accelerators can be much cheaper than the old. The British version of this cost-conscious but potentially creative future is a proposal called EPIC. The aim of EPIC is to continue the probing of matter with leptons — particularly electrons — that has met with such success in recent years, but to probe much more deeply, by using much higher energies than is possible with present-day machines. It is proposed to construct EPIC stage 1 in such a way that it will be possible, in stage 2 at some later date, to add a second accelerator ring that will allow one to study the interactions of colliding beams of electrons and positrons. (UK)

20483 EPIC AS A WINDOW ON THE FORCES OF NATURE. Manning, R. (Science Research Council, Chilton, Eng.). Nature (London).; 255: No. 5508, 453-458(5 Jun 1975).

A proposal was made to the Science Research Council for the construction of a new high energy physics accelerator called EPIC: electron positron intersecting complex. Because of recent experimental discoveries which have challenged earlier theoretical ideas, there is a general expectation that a major advance in the understanding of the basic forces of nature is imminent. EPIC, if constructed, will open up a new energy regime that will provide vital information to guide this advance. (auth)

Experimental Facilities

Refer also to abstracts 19665, 20451, 21085, and 21094.

20484 (CEA-N-1784, pp. 7-8) DEVELOPMENT OF A FAST TRANSPORT DEVICE, USING A GAS JET, FOR NONVOLATILE FISSION FRAGMENTS. Schussler, F.; Bocquet, J. P. 1974. (In French).

In 2nd semi-annual progress report 1974. Semi-annual bulletin No. 6. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale).

Some experimental results obtained with the helium jet device of the Lohengrin separator in the case of ^{96}Sr and ^{96}Y are presented. (FR)

20485 (N-74-34936) PREPARATION OF THICK MOLYBDENUM TARGETS. Singh, J. J. (National Aeronautics and Space Administration, Langley Station, Va. (USA). Langley Research Center). Oct 1974. 18p. (NASA-TM-X-72014). NTIS $3.00.

Thick natural molybdenum deposits on nickel plated copper substrates were prepared by thermal decomposition of molybdenum hexacarbonyl vapors on a heated surface in an inert gas atmosphere. The molybdenum metal atoms are firmly bonded to the substrate atoms, thus providing an excellent thermal contact across the junction. Molybdenum targets thus prepared should be useful for internal bombardment in a cyclotron where thermal energy inputs can exceed 10 kW. (STAR)

20486 (ORNL-5025, pp 79-81) DEVELOPMENT OF A RELIABLE GAS-JET TRANSPORT SYSTEM FOR USE AT THE ORIC. Schmidt-Ott, W. D.; Toth, K. S. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

The helium gas-jet technique has been used extensively in radioactive decay work and has proven to be an extremely useful tool, especially in its application to heavy ion induced reactions, where large amounts of linear momentum are transferred to the product nuclei. Tests and development of the system are briefly described and applications to nuclear spectroscopy are discussed. It is concluded that mating the system with a mass separator should increase its value for the study of nuclei far from stability. (2 figures) (SDF)

20487 DYNAMIC POLARIZATION OF NUCLEI. Jeffries, C. D. (Univ. of California, Berkeley). pp 217-262 of Electron Paramagnetic Resonance. Geschwind, S. (ed.). New York; Plenum Publishing Corp. (1972).

Dynamic nuclear polarization is a general method of enhancing by several orders the polarization of a nuclear spin system in interaction with an electron spin system by saturation of a suitable resonance of the combined system. By way of introduction, the example of nuclei in dipolar coupling with paramagnetic ions diluted in a solid is presented: this case is important in polarizing targets for nuclear scattering. By the simultaneous action of applied microwave fields and lattice relaxations, one can enhance the nuclear polarization up to the magnitude of the electron polarization itself, which is of order unity at 10 kOe and 1°K. The dipolar case in solids is then considered in quantitative detail, under the following headings: model and rate equations, nuclear relaxation, dynamic polarization (ideal case, unresolved lines), spin temperature theory, phonon bottleneck effects, and

applications. Several other cases are discussed more concisely: strong HFS coupling in paramagnetic ions, Overhauser effect, and liquids. The spin refrigerator, a general method of cyclically transferring a large electron spin polarization to nuclear spins without the use of microwaves, is then discussed; after some introductory comments, the properties of Yb: YES, rate equations, and experimental results on Yb: YES are treated. Finally, the subject of optical pumping is examined. (20 figures) (RWR)

PHYSICS (ASTROPHYSICS AND COSMOLOGY)

20488 (JPRS-63092) SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY AND SPACE. No. 333. Translation of Unidentified Russian Articles from Various Journals. 40p. NTIS $3.75.

Translations and abstracts of articles on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial geophysics, covering both science news and formal scientific reports, plus published details of Soviet space "spectaculars" are included. (GRA)

Cosmic Radiation

Refer also to abstracts 19816, 20612, 20616, 20634, 20731, 20751, 20912, and 20960.

20489 (CEA-CONF-3076) DIFFUSE GAMMA RAY MEASUREMENT ABOVE 20 MeV WITH A BALLOON BORNE EXPERIMENT. Parlier, B.; Forichon, M.; Montmerle, T.; Agrinier, B.; Boella, G.; Scarsi, L.; Niel, M.; Palmeira, R. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 1975. 6p. (CONF-750805-3). Dep. NTIS (US Sales Only) $4.00.

From 14th international cosmic ray conference; Munich, F. R. Germany (15 Aug 1975).

During two balloon flights of a spark chamber gamma-ray telescope launched from Sao José dos Campos (Brazil) in 1973, the growth of the secondary gamma rays was monitored as a function of the atmospheric pressure. The extrapolation to zero residual atmosphere giving evidence of an extraterrestrial flux is discussed. (4 figures, 1 table) (auth)

20490 (CEA-CONF-3077) SYNCHROTRON RADIATION, HIGH ENERGY GAMMA RAYS, AND THE DISTRIBUTION OF GALACTIC COSMIC RAYS. Paul, J.; Casse, M.; Cesarsky, C. J. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France)). 1975. 6p. (CONF-750805-5). Dep. NTIS (US Sales Only) $4.00.

From 14th international cosmic ray conference; Munich, F. R. Germany (15 Aug 1975).

Since the results on the galactic longitude distribution of high energy gamma rays of Kniffen et al. (1973) became available, several models have been proposed to explain the observed emission. One such model (Paul, Cassé and Cesarsky, 1974, 1975), which is in agreement with the large scale result of SAS II and which accounts for many other relevant observations has been built; it reconciles quantitative ideas on galactic spiral structure, on the galactic magnetic field, on the containment of the cosmic rays by the field, of the field by the matter. Predictions are compared with new, high resolution (5°) data of SAS II; and some general consequences of the model regarding cosmic ray production and propagation in the galaxy are discussed. (auth)

20491 (CONF-720805-P1, pp 1-13) PRIMARY COSMIC RADIATION. Anderson, H. R. (Rice Univ., Houston, TX). 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

The term cosmic radiation means the charged particle flux that reaches the earth from outside its magnetosphere with energies above the solar wind energy of a few keV. There are two sources of flux. Sporadically the sun produces such particles, generally within the energy range 1–200 MeV, and these solar cosmic rays arrive at the earth for a period ranging from hours to days. There may be a small, rather constant flux from the sun also, but the bulk of the steady flux originates outside the earth's orbit. Although some have conjectured that part of this latter flux may be accelerated in the outer portions of the solar system where the outward flowing interplanetary medium meets the interstellar medium, it is generally thought that most or all of it arises in unique systems such as supernovae, and is distributed throughout the galaxy. These galactic particles range in energy from a few MeV to at least 10^{13} MeV and consist primarily of protons with significant numbers of heavier nuclei, positrons and electrons. They are supposed to fill our galaxy, or at least the disc, more or less uniformly. However, the flux with energies below a few GeV that reaches earth's orbit is modulated by the interplanetary medium so that the number at earth varies inversely with solar activity and is always somewhat below the interstellar flux. A discussion is presented of primary galactic radiation at earth, its modulation by solar activity, and its interaction with the geomagnetic field. (auth)

20492 (LA-UR-75-1122) MODEL COSMIC GAMMA-RAY BURST. Strong, I. B.; Klebesadel, R. W.; Evans, W. D. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-ENG-36. 4p. (CONF-750805-7). Dep. NTIS $4.00.

From 14th international cosmic ray conference; Munich, F. R. Germany (15 Aug 1975).

Observational facts relating to cosmic gamma-ray bursts are briefly summarized and classified into two rough categories: (1) well-established facts and (2) less-well-established facts. Most of the models proposed to explain the phenomena of cosmic gamma-ray bursts are found to be in conflict with the first category and only a few classes of explanations are compatible with both. (BJG)

20493 (LA-UR-75-1123) GAMMA-RAY BURSTS FROM BLACK HOLE ACCRETION DISKS. Strong, I. B. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-ENG-36. 7p. (CONF-750805-1). Dep. NTIS $4.00.

From 14th international cosmic ray conference; Munich, F. R. Germany (15 Aug 1975).

The suggestion was first made more than a year ago that gamma-ray bursts might originate in the neighborhood of black holes, based on some rather circumstantial evidence linking Cygnus X-1, the prime black-hole candidate, with two of the then-known gamma-ray bursts. Since then additional evidence makes the idea still more plausible. The evidence is summarized briefly, a physical model for production of gamma-ray bursts is given, and several of the more interesting consequences of such an origin are pointed out. (auth)

20494 (N-74-35219) MEASURED AND CALCULATED NEUTRON SPECTRA AND DOSE EQUIVALENT RATES AT HIGH ALTITUDES: RELEVANCE TO SST OPERATIONS AND SPACE RESEARCH. Foelsche, T.; Mendell, R. B.; Wilson, J. W.; Adams, R. R. (National Aeronautics and Space Administration, Langley Station, Va. (USA). Langley Research Center). Oct 1974. 68p. (NASA-TN-D-7715; L-9389). NTIS $3.75.

Results of the NASA Langley-New York University high-altitude radiation study are presented. Measurements of the absorbed dose rate and of secondary fast neutrons (1 to 10 MeV energy) during the years 1965 to 1971 are used to determine the maximum radiation exposure from galactic and solar cosmic rays of supersonic transport (SST) and subsonic jet occupants. The maximum dose equivalent rates that the SST crews might receive turn out to be 13 to 20 percent of the maximum permissible dose rate (MPD) for radiation workers (5 rem/yr). The exposure of passengers encountering an intense giant-energy solar particle event could exceed the MPD for the general population (0.5 rem/yr), but would be within these permissible limits if in such rare cases the transport descends to subsonic altitude; it is in general less than 12 percent of the MPD. By Monte Carlo calculations of the transport and buildup of nucleons in air for incident proton energies E of 0.02 to 10 GeV, the measured neutron spectra were extrapolated to lower and higher energies and for galactic cosmic rays were found to continue with a relatively high intensity to energies greater than 400 MeV, in a wide altitude range. This condition, together with the measured intensity profiles of fast neutrons, revealed that the biologically important fast and energetic neutrons penetrate deep into the atmosphere and contribute approximately 50 percent of the dose equivalent rates at SST and present subsonic jet altitudes. (auth)

20495 RELATION BETWEEN THE ENHANCED DIURNAL VARIATION OF COSMIC RAYS AND THE INTERPLANETARY MAGNETIC FIELD. Bussoletti, E.; D'Ambrogio, G. (Univ., Lecce, Italy). Lett. Nuovo Cim.; 13: No. 6, 209-212(7 Jun 1975).

Enhanced events occurring in the period from October to November 1968 are considered in order to calculate the percent amplitude α of the diurnal variation by using the hourly data of high latitude neutron monitors. Asymptotic coordinates are also given. A correlation was calculated between α and the interplanetary magnetic field intensity. Also the maximum correlation factor was found as a function of the time lag and the properties of this factor are discussed. (JFP)

20496 STUDY OF COSMIC RAY MUONS AT LARGE ZENITH ANGLES. Hicks, R. B. Winnipeg, Manitoba; University of Manitoba (1972). 117p.

Thesis.

The operation of a narrow angle scintillation counter telescope, designed to be sensitive to cosmic ray particles travelling at large zenith angles, is described. The telescope was located in the Cosmic Ray Laboratory of the Allen Physics Laboratory, Uni-

versity of Manitoba. During the period Oct. 16, 1967 to Sept. 23, 1969 the telescope was oriented horizontally East-West, and was used to scan the Celestial Equator in search of large (>4%) sidereal anisotropies in the cosmic radiation. A null result was obtained. The telescope was subsequently modified to measure the variation with zenith angle of the intensity of secondary cosmic ray muons arriving with zenith angles in the range 75°–90°. The measured intensities were found to be consistent with those predictable on the basis of pion-kaon parentage of the muons. The data collected during the intensity measurements were examined for the presence of events consistent with the passage of fractionally charged particles (quarks) through the apparatus. Upper limits of the order of $10^{-8}cm^{-2}sr^{-1}s^{-1}$ were established for the directional intensity of such particles. (auth)

20497 EXTRATERRESTRIAL RADIOASTRONOMICAL OBSERVATIONS. Schreiber, R. Postepy Astron.; 23: No. 1, 11-19(1975). (In Polish).

The review describes the achievements of extraterrestrial radioastronomy during the last 10 years. Substantial progress, especially in the observations of the solar corona and the interplanetary space, is reported. Observations of planets and the Galaxy are also mentioned. Some remarks concerning the future experiments are briefly outlined. (auth)

20498 NARROW-ANGLE COSMIC-RAY ANISOTROPIES AND REPLY BY ELLIOTT, H. AND THAMBYAHPILLAI, T. Barrowes, S. (Louisiana State Univ., Baton Rouge). Nature (London).; 255: No. 5504, 171(8 May 1975).

Reference is made to Speller et al (Nature 235: 25 (1972)) who reported a measurement of the diurnal cosmic-ray anisotropy as found with underground muons in London. A quite different interpretation of the data is here presented, based on narrow angle anisotropies. A reply from the 1972 authors is appended, stating that they are sceptical about this different interpretation. (UK)

20499 EFFECT OF IONIZATION LOSSES ON THE COSMIC RAY PROPAGATION. Velinov, P. I. (Inst. of Geophysics, Sofia). Compt. Rend. Acad. Bulg. Sci.; 27: No. 10, 1371-1374 (1974).

New solutions obtained for the effects of ionization losses during the propagation of cosmic rays show their considerable effect on the spectrum of the particles, especially in the region of low energies. The deduced formulas complement previous results and permit the calculation of different spectra and types of particles in different media by chemical composition and degree of ionization. (BJG)

20500 REDUCTION OF SOLAR NEUTRINO FLUX BY VARIABLE FERMI COUPLING CONSTANT AND HIGH ^{3}He ABUNDANCE. Shaviv, G. (Tel Aviv Univ. (Israel). Dept. of Physics and Astronomy). Astron. Astrophys.; 35: No. 3, 385-388(Oct 1974).

3 figs.; 17 refs.

Two recently suggested hypotheses for the explanation of the disagreement between theory and observation of the solar neutrino flux are discussed. It is shown that the two theories, namely the dependence of the weak interaction coupling constant on the gravitational potential and a high initial abundance of ^{3}He cannot reduce the predicted neutrino flux to below the present day upper limit. (auth)

20501 IDENTIFICATION OF HEAVY-PARTICLE COSMIC-RAY TRACKS IN MINERALS FROM METEORITES. Otgonsuren, O.; Perelygin, V. P. Sov. At. Energy (Engl. Transl.); 37: No. 2, 865-867(Aug 1974).

Translated from At. Energ.; 37: No. 2, 164-165(Aug 1974).

To survey the abundance of far transuranic elements in cosmic radiation, particle tracks were examined in silicate minerals of meteoric and lunar origin. Track length versus atomic number and distribution of track lengths for $Z > 35$ are shown. It is concluded that track lengths above 1.1 mm length in olivines could be a reliable demonstration of the existence of far transuranic elements in galactic radiation. 3 figs., 10 refs. (GHT)

20502 ONSET TIME AND RIGIDITY SPECTRUM OF COSMIC RAY STORM IN AUGUST, 1972. Oh, M. S.; Pak, B. S. New Phys. (S. Korea); 14: No. 1, 8-19(1974). (In Korean).

The largest Forbush decreases ever observed were registered on the cosmic ray neutron monitors on August 4-15, 1972 in the world network. The data of 8 mountain level stations and 10 sea level stations were taken to analyze for the rigidity spectrum and the differences in onset times of the cosmic ray storms. 0.73 ± 0.06 was recorded for mountain level stations at 5 A. M. when the depression is largest. In the Forbush decrease of August 4, the onset was earliest in the mean asymptotic direction of 75° to 103° west of the sunearth line and latest in the direction of 135° east. The observed time difference between the earliest and the latest onset is as much as 7 hours. (Korean Sci. Abstr.)

20503 HIGH ENERGY COSMIC RAY HADRONS AND MUONS IN THE ATMOSPHERE. I. Analytic Evaluation of Pion, Kaon, and Muon Distributions in the Atmosphere. Liland, A. Ark. Fys. Semin. Trondheim; No. 5, 68(1975).

Simple models have been used to solve the diffusion equations for mesons in the atmosphere for very high energies. While giving an understanding of some phenomena, they are not conclusive, e.g. for the energy dependence of the μ^+/μ^- ratio at sea level. The diffusion equations for mesons in the atmosphere are solved here for all energies, using results from accelerator experiments together with the scaling hypothesis of high energy hadron collisions to extrapolate to high and very high energies. The meson production by mesons is not negligible and is taken into account, and the decay losses of charged pions and kaons in the atmosphere are significant. The muon charge ratio at sea level is found to increase with energy. The addition of meson production by mesons decreases the muon charge ratio at all energies, but most at higher energies. (NO)

20504 MEASUREMENT OF THE PRIMARY COSMIC ELECTRON SPECTRUM FROM 10 GeV TO ABOUT 250 GeV. Silverberg, R. F. College Park, MD; Univ. of Maryland (1974). 188p. University Microfilms Order No. 74-29,766.

Thesis (Ph. D.).

The intensity and energy spectrum of primary cosmic electrons from 10 to approximately 250 GeV has been studied using two different detectors. Although both of the detectors were large area ionization calorimeters with frequent sampling of showering particles and were capable of energy resolution of 7 percent, one of the detectors was more than 40 radiation lengths and four nuclear mean free paths deep. The experiment was calibrated on electrons from 5.4 to 18 GeV at the Stanford Linear Accelerator and on protons up to 17.6 GeV at the Brookhaven National Laboratories' Alternating Gradient Synchrotron. The results of the balloon flights indicated that the primary cosmic ray electron differential energy spectrum exhibits no change of slope in the energy range measured. Results indicate that the cosmic electron spectrum is steeper than the cosmic proton spectrum. It is shown that these data are consistent with the leakage lifetime model for the propagation of cosmic electrons in the Galaxy, although other more complex models cannot be excluded on the basis of these data. (Diss. Abstr. Int., B)

20505 RELICT IRRADIATION OF IRON METEORITE MATTER BY LOW-ENERGY HEAVY NUCLEI OF COSMIC RAYS. Kashkarov, L. L.; Korotkova, N. N.; Lavrukhina, A. K. (Inst. of Geochemistry and Analytical Chemistry, Moscow). Dokl. Akad. Nauk SSSR; 221: No. 1, 198-200(1 Mar 1975). (In Russian).

Tracks of a low-energy, cosmic-ray component were determined in the El'ga meteorite having a K–Ar age of 2.6×10^9 years by etching in 20% HF at 20°C for a period of 40 to 80 seconds. Most of the samples showed a track density $< 8 \times 10^7$ tracks/cm^2 for cosmic-ray nuclei having a charge $Z < 30$ but > 23. Thus, it is possible to count the tracks by means of an optical microscope. Tracks of different origin (cosmic-ray or fission) could be distinguished by measuring the track diameter. The average track density from uranium fission products in the glass meteorite samples was found to be constant and equal to 1.5×10^8 cm^{-2}, which is a factor of two less than the track density from cosmic-ray nuclei. In a number of samples a continuous decrease in track density was observed on going from the edge of the sample into the sample depth. There is a two- to ten-fold decrease in track density at a depth of 60 to 200 microns from the edge of the sample, with 200 microns being the maximum penetration depth for the cosmic-ray nuclei. (1 figure, 1 table) (SJR)

20506 MUON CHARGE RATIO AND THE MASS COMPOSITION OF PRIMARY COSMIC RAYS. Erlykin, A. D. (Lebedev Physical Inst., Moscow); Ng, L. K.; Wolfendale, A. W. J. Phys., A (London); 8: No. 5, L51-L54(May 1975).

The charge ratio of single muons at ground level taken together with knowledge of the characteristics of high-energy nucleon-nucleus interactions in the atmosphere enables information to be gained about the mass composition of the primary cosmic radiation. In particular, the ratio of the number of neutrons (bound in nuclei) to protons and neutrons together can be determined. It is shown that the latest measurements from the Utah group (Ashley, Keuffel and Larson (to be published)) can be interpreted in terms of a composition at primary energies of the order of 10^{13} eV/nucleon not very different from that below about 10^{11} eV/nucleon where direct measurements have been made. (auth)

20507 FREQUENCY SPECTRA OF VARIATIONS IN COSMIC RAY INTENSITY AND SOLAR ACTIVITY IN LOW-FREQUENCY REGIONS. Kolomeets, E. V.; Shvartsman, Ya. E. Izv. Akad. Nauk Kaz. SSR, Ser. Fiz.-Mat.; No 6, 19-23(1974). (In Russian).

Variations in cosmic ray intensities and indexes characteriz-

ing solar activity with periods close to those of the rotation of planets of the solar system were studied. Variations with periods of 180 and 500 days were also considered along with coefficients of correlation between these variations in cosmic rays and solar activity and their energy spectra. (tr-auth)

20508 ENERGY SPECTRA OF FORBUSH EFFECTS. Aldagarova, Kh. Z.; Kolomeets, E. V.; Kupchishin, A. I.; Musabaev, M. A.; Pivneva, V. T. Izv. Akad. Nauk Kaz. SSR, Ser. Fiz.-Mat.; No. 6, 9-14(1974). (In Russian).

Energy spectra are calculated for Forbush effects, using amplitude ratios at sea level and mountain tops at high-latitude stations, which allow excluding changes in rigidity of the geomagnetic cut-off at the time of the Forbush decline. It is assumed that the energy spectrum is described by a stepwise function. (tr-auth)

Stars

Refer also to abstracts 19844, 20493, 20623, 20676, and 20711.

20509 (AD/A-001305) FOURTH-ORDER APPROXIMATION FOR THE ROTATIONAL DISTORTION OF STARS OF ARBITRARY STRUCTURE. Final Report. Kopal, Z.; Mahanta, M. K. (Naval Research Lab., Washington, D. C. (USA)). 8 Nov 1974. 22p. NTIS $3.25.

Clairaut's theory of the rotational distortion of self-gravitating configurations of arbitrary structure, arising from axial rotation with constant angular velocity, previously developed to quantities of third order in superficial distortion, has now been extended to fourth-order terms. The differential equations governing the form and exterior potential of stars rotating in the previously described manner have been set up by the method followed in a previous paper, together with their boundary conditions. Their applications to practical cases are being postponed for a subsequent investigation. (GRA)

20510 (COO-3071-113) NEUTRINO ASTROPHYSICS. Bludman, S. A. (Pennsylvania Univ., Philadelphia (USA). Dept. of Physics). 17 Jan 1975. 36p. (CONF-741215-3; UPR-0036T). Dep. NTIS $5.00.

From seventh Texas symposium on relativistic astrophysics; Dallas, Texas, USA (16 Dec 1974).

Neutrino or antineutrino emission from collapsing or bouncing stars is considered. Up to 10^{15} GM cm^{-3}, a hot neutron fluid behaves like an ideal gas and the neutron–proton ratio is generally less than that of a cold neutron star. The neutrino diffusion approximation is expected to be valid down to E/sub upsilon/ equals 8 MeV, but the Fermi statistics and the energy dependence of weak cross-sections lead to important differences between photon- and neutrino-emitting stars. From the energy release in collapse of a degenerate core to neutron star radius and the dynamics of free-fall, a period T approximately 1 ns and pulse width DELTA T greater than 14 mu s is expected. The dynamics of rich clusters of galaxies is discussed. It is shown that the cluster missing mass cannot be attached to massive superhalos about the galaxies but must be in intergalactic objects of lower mass. (BJG)

20511 (INIS-mf-1765, pp 35-42) THE SPECTRUM OF THE SUPERGIANT EPSILON ORIONIS (BO Ia). 2. Radial Velocities Curve of Growth Analysis. Lamers, H. J. G. L. M. 16 Sep 1974.

In studies on the structure and stability of extended stellar atmospheres. (Rijksuniversiteit Leiden (Netherlands)).

The visual spectrum of the supergiant ϵ Ori (BO Ia, HD 37128) is discussed. Differential radial velocities are shown to be absent, except for Hα, which seems to show a negative velocity. A simple curve of growth analysis yields an ionization temperature of 25000 K, except for Si which yields a somewhat lower temperature. The LTE-abundances derived agree very well with those in τ Sco (BO V), which may indicate that ϵ Ori has not yet passed through the red-giant stage. The microturbulent velocity is at least 16 km/s and possibly 28 km/s. The presence of the two unidentified emission lines at 4500 Å is reported, as well as some indications that line emission fills in several absorption lines, which are characteristic for Of stars. (auth)

20512 (INIS-mf-1765, pp 43-72) THE SPECTRUM OF THE SUPERGIANT EPSILON ORIONIS (BO Ia). 3. The Basic Parameters. Lamers, H. J. G. L. M. 16 Sep 1974.

In studies on the structure and stability of extended stellar atmospheres. (Rijksuniversiteit Leiden (Netherlands)).

The spectroscopic and photometric observations and the angular diameter of the star ϵ Ori (HD 37128, BO Ia) are compared with predictions from a grid of NON-LTE model atmospheres. The absolute flux at 4430 Å, the Balmer jump, the equivalent widths of Hβ and Hγ and the Si IV/Si III ratio are predicted correctly by a plane parallel Non-LTE model atmosphere with $T_{eff} = 30{,}500 \pm 2000$ K and $\log g = 3.0 \pm 0.1$ cm s^{-2}. There is no evidence for Lyman α pumping of the He^+ (2-4) transition. The absolute flux distribution shows that the hump at 2200 Å in the interstellar extinction curve is very small in the direction of ϵ Ori. The corrected flux distribution in the visual region is steeper than predicted. The small flux deficiency in the near ultraviolet indicates that T_{eff} is at least 500 K smaller than found from the visual spectrum. There are no indications for sphericity effects in the atmosphere of the star. The basic parameters are $T_{eff} \gtrsim 30{,}000 \pm 2000$ K, $\log g = 3.0 \pm 0.1$ cm s^{-2}, $R_x = 3^{+1}_{-2}\cdot^{+3}_{-3} R_\odot$, $M_x = 35^{+25}_{-8} M_\odot$, $\log (L/L_\odot) \gtrsim 5.88^{+.22}_{-.11}$. These values agree reasonably with published evolutionary tracks. (auth)

20513 (INIS-mf-1765, pp 73-80) THE EQUIVALENT WIDTHS OF Mg II LINES NEAR 2800 A IN THE SPECTRA OF 31 STARS. Lamers, H. J. G. L. M.; Hucht, K. A. van der; Snijders, M. A. J.; Sakhibullin, N. 16 Sep 1974.

In studies on the structure and stability of extended stellar atmospheres. (Rijksuniversiteit Leiden (Netherlands)).

The total equivalent width of the Mg II lines λ2795.5, λ2802.7 ($3s^2S-3p^2P^0$) and λ2798.0 ($3p^2P^0-3d^2D$) has been measured in the spectrograms of 31 stars, observed by the Orbiting Stellar Spectrophotometer S59. After corrections for the interstellar components have been applied, the equivalent width in various types of stars is compared with each other. The B-type supergiants o^2CMa and ηCMa show stronger Mg lines than normal stars, whereas the peculiar star α^2CVn has weak lines. Two Be stars show weak lines and two Be stars show normal line strength. In middle and late B-type stars of class II-V the observed equivalent widths agree with Non-LTE predictions, but in early B stars the observed lines are too strong. Several possible explanations for the origin of this discrepancy are discussed. (auth)

20514 (INIS-mf-1765, pp 81-114) OBSERVATIONS AND THEORY OF Mg II LINES IN EARLY TYPE STARS. 2. Theory and Predicted Profiles. Snijders, M. A. J.; Lamers, H. J. G. L. M. 16 Sep 1974.

In studies on the structure and stability of extended stellar atmospheres. (Rijksuniversiteit Leiden (Netherlands)).

The profiles of the Mg II lines at 2795.5 and 2802.7 Å (3^2s-3^2P), 2790.7 and 2798.0 Å (3^2P-3^2D), 4481.1 and 4481.3 Å (3^2D-4^2F) are computed in a grid of model atmospheres with $8000 \leq T_{eff} \leq 35000$ K and $2.5 \leq \log g \leq 4.0$ by means of LTE and Non-LTE theories of line formation. The effects of the various physical assumptions on the strength of the Mg II lines are discussed. The lines are sensitive to the amount of UV line blanketing in atmospheres of $T_{eff} \geq 15000$ K. The inclusion of the optically forbidden 3s-3d transition is important for the evaluation of the 3d-level population. The equivalent width, the central depression and the full half-width of the lines are presented in a form useful for comparison with the observations. (auth)

20515 (INIS-mf-1765, pp 115-152) OBSERVATIONS AND THEORY OF Mg II LINES IN EARLY TYPE STARS. 3. The Observations and a Comparison with the Predictions. Lamers, H. J. G. L. M.; Snijders, M. A. J. 16 Sep 1974.

In studies on the structure and stability of extended stellar atmospheres. (Rijksuniversiteit Leiden (Netherlands)).

The equivalent width of the ultraviolet Mg II lines from the 3s-3p and 3p-3d transitions in the spectra of 106 stars and of the visual lines from the 3d-4f transition in 48 stars of type O4 to A3 are presented. The ultraviolet observations were made by the Orbiting Stellar Spectrophotometer S59, the Copernicus Satellite and various balloon experiments. The visual observations were collected from the literature. The observed equivalent widths in normal stars of classes Ia to V agree roughly with the predictions over the entire range from O8-A2 if an abundance of $Mg/H = 3 \cdot 10^{-5}$ is adopted. In these stars no evidence was found for differences in the magnesium abundances, which indicates that the cosmic abundance is close to the solar value of $Mg/H = 2.9 \times 10^{-5}$. The strength of the Mg II lines in the spectra of the five peculiar stars, three Be-stars and three shell-stars are briefly discussed. (auth)

20516 (INIS-mf-1765, pp 153-168) MASS LOSS FROM THE A-TYPE SUPERGIANT α Cyg. Lamers, H. J. G. L. M. 16 Sep 1974.

From discussion meeting on astronomy in the ultraviolet; London, United Kingdom (9 Apr 1974).

In studies on the structure and stability of extended stellar atmospheres. (Rijksuniversiteit Leiden (Netherlands)).

The Mg II resonance lines in α Cygni (A2Ia) are studied from 22 spectral scans obtained by the experiment S59. The cores of the resonance lines are shifted by −130 km/s and the short wavelength side of the core is shifted about −350 km/s. The lines are compared with predicted profiles in an expanding atmosphere. This comparison suggests a rate of mass loss of $-dM/dt \leq 3.10^{-10}$ $M_\odot$/yr. The atmosphere seems to be accelerated up to velocity of 300 km/s. The acceleration might be produced by the near-UV

resonance lines of singly ionized metals. The observations of the near-UV spectrum of A-type supergiants with a high spectral resolution are recommended. (auth)

20517 (INIS-mf-1765, pp 169-200) CHARACTERISTICS OF NON-THERMALLY HEATED STELLAR ATMOSPHERES. Lamers, H. J. G. L. M.; Kuperus, M. 16 Sep 1974.

In studies on the structure and stability of extended stellar atmospheres. (Rijksuniversiteit Leiden (Netherlands)).

A study is made of the structure of non-thermally heated stellar atmospheres as a function of the mechanical energy flux and the dissipation length. The conditions for a stationary atmosphere with and without mass loss are discussed. Three characteristic types of atmospheres are considered: atmospheres in hydrostatic equilibrium, loosely bound atmospheres with a strong radiation pressure. For the first two types of models we derive order-of-magnitude estimates for the maximum temperature and the rate of mass loss. The influence of chromospheric heating on the conditions at the critical point in an atmosphere with a strong radiation pressure is discussed. The results are compared with the observed temperatures and rates of mass loss in the sun, an M-type supergiant and BO-type supergiant. (auth)

20518 (INIS-mf-1765, pp 201-232) NON-THERMALLY HEATED ATMOSPHERES OF EARLY TYPE STARS. Lamers, H. J. G. L. M.; Loore, C. de. 16 Sep 1974.

In studies on the structure and stability of extended stellar atmospheres. (Rijksuniversiteit Leiden (Netherlands)).

The evidence for predicted and observed mechanical fluxes in early type stars is collected. The coincidence of a large mechanical flux and a large rate of mass loss in early type supergiants and in late type supergiants suggests that the mass loss phenomenon is related to the dissipation of mechanical flux and consequently to the presence of a chromosphere. The resemblance in the temperature dependence of the microturbulent flux and the predicted flux-of-radiation driven sound waves suggests that these phenomena are associated. The observed short-time variations in the line profiles of some early-type stars indicate the presence of sound waves with a wavelength equal to the photospheric pressure scale height. A partial grid of model chromospheres was computed, assuming that the dissipation of mechanical flux can be described by the weak-shock theory, and that the effective gravity is positive throughout the chromosphere. The maximum temperature and the mass flux can be expressed in simple formulae of the mechanical flux and the period of the shocks. The computed chromospheric temperature of early type stars is much larger than observed. This indicates that the flow passes the critical point in the chromosphere, which requires a negative effective acceleration. (auth)

20519 (LA-UR-75-1038) PARTICLE ACCELERATION NEAR AN ACCRETING BLACK HOLE. Ames, S. (Los Alamos Scientific Lab., N. Mex. (USA)). Aug 1975. Contract W-7405-ENG-36. 5p. (CONF-750805-6). Dep. NTIS $4.00.

From 14th international cosmic ray conference; Munich, F. R. Germany (15 Aug 1975).

An electrically charged, rotating black hole can polarize the surrounding vacuum, leading to the creation of 10^{20}- to 10^{21}-eV electrons and positrons. The particles are produced in short bursts in time. The spectrum of particles produced by this process and their angular distribution are calculated, and the time behavior of some models is discussed. (3 figures) (auth)

20520 (N-74-35244) FOUR STOKES PARAMETER RADIO FREQUENCY POLARIMETRY OF A FLARE FROM AD LEONIS. Spangler, S. R.; Rankin, J. M.; Shawhan, S. D. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy). Jul 1974. 19p. (NASA-CR-140520). NTIS $4.00.

Observations of the four Stokes parameters of a 430 MHz flare from the UV Ceti-type star AD Leonis are presented. The maximum amplitude of the event was 0.52 flux units and the durations at one-half and one-tenth maximum were 12 and 40 seconds, respectively. The degree of circular polarization at maximum intensity was approximately 56 percent and was later observed to be as high as 92 percent. Linear polarization was also observed at a level of about 21 percent at flare maximum which allowed an upper limit of 440 radians/sq m to be placed on the rotation measure. (auth)

20521 (N-75-11808) RAPID VARIATIONS OF BALMER LINE STRENGTHS IN THE SPECTRA OF Be STARS. McBeath, K. B. (Northwestern Univ., Evanston, Ill. (USA)). Aug 1974. 94p. (NASA-CR-140812). NTIS $4.75.

Thesis.

Low resolution photoelectric spectrophotometric measurements of the first four members of the Balmer series in the spectra of one Be and five Be (shell) stars were obtained with the 92-cm telescope and image dissecting scanner. Equivalent widths were computed for each observation, and their standard deviations from the mean values were examined. Results indicate that in three of the program stars, at least one of the Balmer lines shows significant fluctuations in equivalent width. These fluctuations amount to a few percent of total line strength and the time scales appear to be on the order of three to thirty minutes. The fluctuations are not always present in a given star, indicating that the mechanism producing them may not be continuous. The noncontinuous and nonperiodic nature of the variations, along with their short time scale suggest some form of flare-like or shock origin for the phenomenon. (auth)

20522 (NP-20421) EQUATION OF STATE AT ULTRA HIGH DENSITIES. Part II. Canuto, V. (Niels Bohr Institutet, Copenhagen (Denmark); Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)). 1974. 103p. Dep. NTIS (US Sales Only) $8.25.

Equations of state in the high density region $p \geq 2 \times 10^{14}$ g.cm^{-3} are discussed. The appearance of hyperons at densities higher than nuclear density is reviewed, and the hypothesis that a liquid of neutrons could solidify at high enough densities is examined. Attempts to describe the behavior of matter in the relativistic region at densities greater than 10^{16} g.cm^{-3} are discussed. The present available data on neutron stars are shown to be insufficient to pin down the velocity of sound at super high densities, but a possible answer is found by analyzing multiparticle production in high energy p-p scattering. The Landau hydrodynamic model is reviewed and it is found that the value $c_s^2 \to 1$ seems favored. (8 tables, 12 figures, 79 references) (auth)

20523 POLYTROPIC STELLAR MODELS IN THE PROJECTIVE THEORY OF RELATIVITY. Kallio, H. (Aarne Karjalainen Observatory, Oulu, Finland). Physica; No. 411, 1-29(1974).

Polytropic stellar models in the projective theory of relativity are studied. There are solutions very accurately equivalent to general-relativistic polytropes examined by Trooper, but also quite different solutions, which give very large redshifts. (auth)

20524 DYNAMIC METHOD FOR ESTIMATING THE RELATIVE STELLAR MASSES IN GLOBULAR CLUSTERS. Baranov, A. S. (Leningrad State Univ.). Vestn. Leningrad. Univ., Mat., Mekh., Astron.; 122-130(Jul 1974). (In Russian).

For the estimation of relative stellar masses in globular clusters, a method is proposed that is based on the comparison of statistical mean distances (obtained with the aid of numerical experiments) of stars of various masses from the cluster center with corresponding observation values. For illustration, the method is applied to three globular and two open star clusters. The results indicate a close dependence between stellar masses and their luminosities in all the cases considered. (IAA)

20525 NITROGEN FLASH SPECTRUM OF HERCULES NOVA IN 1963. Hang, H. J.; Mo, C. E.; Liu, J. L. Tien Wen Hsueh Pao; 15: No. 1, 43-50(Apr 1974). (In Chinese).

A spectrophotometric study of the nitrogen flash spectrum of Hercules nova in 1963 is reported. The measurement results of equal-value width of emission line relative intensities, and energy distributions of the continuous spectrum are tabulated. In analyzing the measurement results, the following characteristics are discovered by comparing the nitrogen flash spectrum with the spectrum prior to the nitrogen flash. (1) During the nitrogen flash, the spectral line intensities allowing for high-ionization quantum jump are obviously enhanced compared to low ionization intensities. The intensities of the spectral line restraining high-ionization quantum jump is obviously weaker than for the low ionization. (2) During the nitrogen flash, the intensities of the continuous spectrum related to the emission lines are increased. The blue zone of the continuous spectrum is considerably stronger than the red zone; in other words, the color temperature is increased. According to the above-mentioned characteristics of the nitrogen flash spectrum, the authors put forward the following views on the explanation of the nitrogen flash phenomenon: (1) Of the main characteristics of the nitrogen flash, the intensifying and weakening of the spectral line at NIII 4640 wavelength result from the intensifying and superposition of the high ionization spectral line of NIII 4640, CIII 4647, and CIV 4659. (2) The phenomenon of the nitrogen flash was due to a small explosion of the nova prior to the nitrogen flash. Thereupon, this ejected thin-shell layer gradually expands and thins out, then at a certain period, the nitrogen flash occurred. (JPRS)

20526 DYNAMICS OF SHELLS OF Be-STARS IN A TOROIDAL MAGNETIC FIELD AND THE STABILITY OF SHELL MOTION. Morozov, V. N. (Leningrad State Univ.). Vestn. Leningrad. Univ., Mat., Mekh., Astron.; 137-141(Jul 1974). (In Russian).

20527 SPECTROPHOTOMETRIC STUDY OF STARS HAVING COMPOSITE SPECTRA. Chkhikvadze, Ya. N.; Khamdi, M. A. (Tbilisi State Univ., USSR). Soobshch. Akad. Nauk Gruz. SSR; 77: No. 1, 61-64(Jan 1975). (In Russian).

The results of a spectrophotometric study of seven stars suspected to have composite spectra are reported. The stars under consideration are shown to be physical binary systems. (1 table) (auth)

20528 MULTIPLE SCATTERING OF RESONANCE RADIATION IN A PLANE LAYER AND IN A SPHERE. Sabashvili, Sh. A. (Tbilisi State Univ., USSR). Astrophysics.; 9: No. 2, 154-165(1973).

Translated from Astrofizika; 9: No. 2, 273-292(1973).

The integral equations for the functions $Q(\tau,\tau_0)$ and $R(\tau,\tau_0)$, which describe multiple scattering of light in a plane layer and in a sphere, are solved numerically in the case of scattering in a resonance line. It is assumed that there is complete frequency redistribution of the radiation in an elementary scattering event with a Doppler coefficient of absorption in the line. The results are presented in the form of tables and graphs for a number of optical thicknesses τ_0 and photon survival probabilities λ. Possible applications of the functions Q and R in astrophysics are pointed out (determination of the mean number of photon scatterings in a plane layer and in a sphere, calculation of the functions $X(z,\tau_0)$ and $Y(z,\tau_0)$, and so forth). (auth)

20529 INTERMEDIATE STATE IN SUPERCONDUCTING NEUTRON STAR. Bruk, Yu. M. (Inst. of High-Pressure Physics, Moscow). Astrophysics.; 9: No. 2, 134-143(1973).

Translated from Astrofizika; 9: No. 2, 237-256(1973).

A study is made of type I proton superconductivity in the mantle of neutron stars (pulsars). At a sufficiently small value of the proton energy gap ($\Delta_p \gtrsim 10^{-3}$ MeV), such a possibility would appear to be realized in reality. The presence in pulsars of magnetic fields $\gtrsim 10^{12}$G leads to the appearance in the mantle of domain magnetic structures of the type of an intermediate state in type I superconductors. The characteristic times of formation of such structures coincide in order with the times of active slowing down (for example, with the period doubling time) or, possibly, with the radio lifetime of the pulsars. Estimates are made of the gap Δp and the characteristic domain sizes ($\sim 10^{-2}-1$ cm). The geometry of the simplest domain structures and the evolution of the superconducting properties of a neutron star when it cools are discussed. (auth)

20530 THERMAL WAVES IN STARS. Klimishin, I. A. (Lvov State Univ.). Astrophysics.; 9: No. 2, 173-179(1973).

Translated from Astrofizika; 9: No. 2, 307-317(1973).

The motion of strong thermal waves in stellar envelopes is analyzed. A relation is found between the density of liberated energy and the depth of the explosion beginning with which a thermal wave, moving toward the surface of the star, does not degenerate into a shock wave. The applicability of the solutions that are obtained to the interpretation of nova explosions is briefly discussed. (auth)

20531 BINARY SYSTEMS WITH AN X-RAY COMPONENT. Jarzebowski, T. (Obserwatorium Astronomiczne Uniwersytetu, Wroclaw). Postepy Astron.; 23: No. 1, 33-53(1975). (In Polish).

This article presents a review of all hitherto known X-ray binaries: Cyg X-3, Cyg X-2, Her X-1, Cen X-3, 2U 1700-37, SMC X-1, Sco X-1, Cyg X-1, Vel X-1, Cir X-1. (auth)

20532 DISTRIBUTION OF ENERGY IN THE CONTINUOUS SPECTRUM OF VEGA AND AGENA IN THE RANGE 2000 TO 3800 Å. Gurzadyan, G. A.; Oganesyan, D. B. (Byurakan Astrophysical Observatory, Erevan). Astrophysics.; 9: No. 2, 111-117 (1973).

Translated from Astrofizika; 9: No. 2, 197-208(1973).

Results are given of evaluation of short-wavelength spectrograms of Vega (α Lyr, A0V) and Agena (β Cen, B1 II) in the range 2000-3800 Å. The spectrograms were obtained by means of the orbital astrophysical observatory Orion-1 on the piloted satellite Salyut-1. It was found that the spectral sensitivity of the Orion apparatus changed somewhat after it had been in space for two months. The observed energy distribution in the continuous spectrum of Vega for 2000-3800 Å agrees well with theory. In the case of Agena, the observations agree with theory if the effective temperature 30,000°K is assumed for the spectral region 2000-3600 Å, which differs appreciably from the ordinary temperature of a star of class B1 (24,000°K). (auth)

20533 PROFILES OF Hα EMISSION LINE IN THE SPECTRA OF IRREGULAR VARIABLES. Zaitseva, G. V.; Kolotilov, E. A. Astrophysics.; 9: No. 2, 104-110(1973).

Translated from Astrofizika; 9: No. 2, 185-196(1973).

The Hα emission profiles were determined for 22 irregular variables. The observations were made with an image-tube spectrograph set up on a 125-cm reflector (dispersion 20 Å/mm). The profiles indicate that a gas envelope is the source of the Hα emission. It is assumed that all the investigated stars are related in this respect, despite the variety of their spectral types (from B to M) and luminosities. The profiles are evidently determined by a velocity field, the motions in the envelopes being varied: rotation, expansion, and contraction. Rapid changes in the profiles were found in the variables BN Ori, UX Ori, VX Cas, and WW Vul. (auth)

20534 BLACK HOLES AS COMPONENTS OF MASSIVE EMISSION STARS. Guseinov, O. Kh. (Shemakha Astrophysical Observatory, USSR). Astrophysics.; 9: No. 2, 166-169(1973).

Translated from Astrofizika; 9: No. 2, 293-300(1973).

In a search for black holes, four stars whose spectra exhibit emission are considered. In all these systems the invisible component is more massive than the visible one. The analysis is based on literature data and observations made at the Shemakha Astrophysical Observatory. No particular features characteristic of relativistic stars were found in the systems. It is shown that most promising candidates for black holes are to be found among the x-ray sources in the arms of this galaxy and identified with massive emission stars earlier than A3, giants of the spectral class M, and red supergiants. Ways of searching for them are indicated. It is shown that when one of the components of a binary system collapses, it is probable that fewer than a tenth of the binary stars remain as a pair. (auth)

20535 MECHANISMS OF LIGHT VARIABILITY OF MAGNETIC STARS. Stepien, K. (Obserwatorium Astronomiczne Uniwersytetu, Warsaw). Postepy Astron.; 23: No. 1, 21-32(1975). (In Polish).

Recent photometric data (in particular obtained in the far ultraviolet) are discussed. Possible mechanisms of light variability are reviewed. It is shown that variations of effective temperature have no firm theoretical foundations and are not able to explain the observations. Also silicon patches cannot be the only cause of light variations. The most promising mechanism seems to be a combination of variable absorption in far ultraviolet and variable blanketing in the whole spectrum, caused by nonuniform distribution of many elements. (auth)

20536 HARMONIC ANALYSIS OF THE LIGHT OF DQ HERCULIS. Kiplinger, A. L.; Nather, R. E. (Univ. of Texas, Austin). Nature (London).; 255: No. 5504, 125(8 May 1975).

It is stated that DQ Herculis is the only nova known to show rapid periodic optical variations. These variations are of low amplitude and have a period of ~71 sec. A study of the harmonic components of this periodicity is here described, and it is shown that the results place severe limits on available models for the variation. Observations were made in the summer of 1973 at the Cassegrain focus of the 2.08 telescope at McDonald Observatory using a high speed two-channel photometer. It was found that the 71 sec variation is a sinusoid of remarkable purity, with a small harmonic contribution to the power occurring only at the frequency of the first harmonic. (UK)

20537 MOLECULES IN DENSE INTERSTELLAR CLOUDS. Robinson, B. J. (Radiophysics Lab., Sydney). pp 159-183 of Interstellar Medium. Pinkau, K. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From proceedings of NATO Advanced Study Institute; Schliersee, Ger (2 Apr 1973).

Complex interstellar molecules are discussed. Topics include molecules found, frequencies observed, confidence level of identifications, location of molecules, and, with respect to molecular clouds, size, temperature, density, and mass. Isotopic species, the formation of molecules, and biological implications are also mentioned. (BJG)

20538 CATACLYSMIC VARIABLES AND γ-RAY OUTBURSTS. Vidal, N. V.; Wickramasinghe, D. T. (Australian National Univ., Canberra. Mount Stromlo and Siding Spring Observatories). Astron. Astrophys.; 36: No. 2, 309-310(Nov 1974).

1 tab.; 12 refs.

A number of cataclysmic variables are found within the error boxes of γ-ray outbursts. The flickering time scale of a superhot spot on the disk surrounding the primary may explain the fine structure of the γ-ray outbursts. (GE)

20539 INVESTIGATION OF THE EMISSION LINE SPECTRA OF THE RED DWARFS. Shakhovskaya, N. I. Izv. Krym. Astrofiz. Observ.; 51: 92-109(1974). (In Russian).

Results of spectrophotometric investigations of 43 solar neighborhood dwarf stars with emission lines of hydrogen and Ca II in their spectra are given. The equivalent widths of emission lines, their relative intensities and the fluxes for the chromospheres in the hydrogen lines were determined. These characteristics are compared with absolute luminosities of the stars and their flare activity level. From this comparison one concludes: The Balmer emission decrement does not vary for different stars into interval of the magnitude $M_V = 8.5 + 13.5m$. The ratio of the Ca II emission line intensity to the hydrogen line intensity is less

for the more luminous stars. The comparison stellar and solar chromospheres data allow to suppose that the chromospheres of the more luminous stars have higher temperature or/and the less mean density. There is a positive correlation between the energy radiated by the quiet stellar chromosphere and the energy that radiated during flares. The contribution of the flares and quiet chromosphere in the total stellar radiation is higher for the less luminous stars. The upper limit of the stellar chromosphere fluxes in hydrogen lines is the less for the more luminous stars for the magnitude interval $M_V = 7 \div 13.5$m. (auth)

20540 ENERGY DISTRIBUTION IN THE SPECTRUM OF EXCESS RADIATION IN MAXIMA OF FLARES OF UV Cet-TYPE STARS. Chugainov, P. F. Izv. Krym. Astrofiz. Observ.; 51: 110-116(1974). (In Russian).

On the basis of results obtained earlier the conclusion has been made that the continuous emission dominates in the spectra of excess radiation of flares of UV Cet-type stars. The data of photoelectric observations on the energy distribution in the spectrum of excess radiation in maxima of flares of UV Cet-type stars are discussed here. The comparison is carried out of observations with the spectrocolorimeter selecting three regions of spectrum free of emission lines and those which are in the photometric UBV-system. The material consists of spectrocolorimetric observations of 9 flares of EV Lac and of UBV-observations of 7 flares of EV Lac, 15 flares of AD Leo and 11 flares of YZ CMi. The reduction of spectrocolorimetric observations to the UBV-system is made. No essential differences are found between the results of spectrocolorimetric and UBV-observations. The value of the emission Balmer jump obtained approximatively from the three values of lg fλ corresponding to the wave lengths λλ 3500, 4217 and 5220 Å is lg (f_{3650-}/f_{3650+}) = +0.16, i.e., the same as was found by us earlier. (auth)

20541 EMISSION BALMER DECREMENT AND ELECTRON DENSITY IN UV Cet-TYPE STAR FLARES. Gershberg, R. E. Izv. Krym. Astrofiz. Observ.; 51: 117-125(1974). (In Russian).

Emission Balmer decrement in UV Cet-type star flare spectra are analyzed in the framework of the radiation theory for the optically thick in lines hydrogen plasma. Supposing $T_e = 15000 \div 20000$°K in lines' origin regions the observed Balmer decrements can be represented by this theory if $n_e = 10^{12} \div 10^{14}$ cm^{-3} and L_α-quantum escape probability $\beta_{21}^0 = 10^{-5} \div 10^{-4}$. Spectroscopical values n_e^S obtained are $10^2 - 10^4$ times as large as compared to photometrical values n_e^Φ that have been found from flare light curves. This fact indicates that recombination relaxation is not the main process that determines flare decay rates. (auth)

20542 MEASUREMENTS FOR CRAB NEBULA AND THE PULSAR NP 0532 IN THE HARD X-RAY REGION. Zimmermann, H. U. (Max-Planck-Institut fuer Physik und Astrophysik, Garching/Muenchen (F. R. Germany). Inst. fuer Extraterrestrische Physik). Astron. Astrophys.; 34: No. 2, 305-307(Aug 1974).

3 figs.; 12 refs.

On July 2, 1971, an X-ray experiment was performed in Palestine, Texas (USA). The experiment consisted of 2 NaI(Tl)-detectors with a field of view of about 10° FWHM. The index of the differential energy spectrum for the nebula was found to be −0.95. Furthermore, light-curves of the pulsar NP 0532 were derived with a time resolution of 0.5 ms and 1 ms. From these curves the ratio of the pulsed to the whole radiation was found to be 20%. Within the measured energy range, no dependence of this ratio on the quantum energy could be found. The index of the pulsed spectrum was derived as −1.02. The results are discussed. (auth)

20543 SUPERFLUID NEUTRON STAR CORES. De Angelis, U. (Astronomy Observatory, Naples); De Cesare, L. Lett. Nuovo Cim.; 13: No. 2, 79-82(10 May 1975).

Some comments are made on the possible existence of superfluidity in neutron star cores, and some immediate consequences due to the new properties of the core are investigated. It is concluded that neutron stars cannot be formed in this way. (JFP)

20544 EFFECTS OF COLLISIONS WITH NEUTRALS ON THE DYNAMIC STABILITY OF A COMPOSITE HYDROMAGNETIC MEDIUM. Bhatia, P. K.; Ariel, P. D. (Univ. of Jodhpur, India). Istanbul Univ. Fen Fak. Mecm., Seri A; 37: 127-134(1974).

The dynamic stability of a composite hydromagnetic medium has been studied to include simultaneously the effects of viscosity and the collisions with neutrals. The stratification in the density has been assumed to be one dimensional and in a direction transverse to that of the prevalent uniform horizontal magnetic field. A variational principle is first shown to characterize the problem. The dispersion relation has been obtained by making use of the existence of the variational principle, for an exponentially varying density distribution. It is found that the stability criterion is independent of both viscosity and the collisions with neutrals. (auth)

20545 RADIAL PULSATIONS OF A COMPOSITE MODEL. Srivastava-Jaipal, K. M. (Univ. of Jodhpur, India). Istanbul Univ. Fen Fak. Mecm., Seri A; 37: 113-119(1974).

Small adiabatic radial pulsations of a composite model have been studied. The model is supposed to consist of a core with density varying as $RHO = RHO_c (1 - r^2/R^2)$ and a constant ν, the ratio of specific heats, for the stellar material. The core is surrounded by a concentric spherical envelope in which the density varies inversely as the square of the distance from the centre, and ν also decreases continuously from the interface. Moreover, the density is supposed to be continuous across the interface and the mass of the envelope is not negligible. The variation of ν is rather arbitrary but a number of particular cases for the values of different parameters of the law of variation have been studied. It is found that the model as a whole can have stable oscillations. (2 tables) (auth)

20546 ADIABATIC PULSATIONS OF THE ROTATING STARS WITH A CONSTANT TEMPERATURE GRADIENT. Ureche, V. (Univ. of Cluj); Lungu, N. Bull. Astron. Inst. Czech.; 26: No. 2, 116-119(1975).

The equations of the adiabatic pulsations for a star with slow rotation (neglecting the rotational distortion) is considered. For the case when only a certain superficial envelope of the star pulsate, and its temperature gradient is constant, the solution is given in terms of a degenerate hypergeometrical series. The angular velocity, for which the pulsations become unstable, depends on the thickness of the envelope and the last quantity depends on the temperature gradient. The overtones, above a given limit, are unstable. (auth)

20547 HYPOTHESIS OF THE BINARY ORIGIN OF Be STARS. Kriz, S.; Harmanec, P. (Astronomical Inst., Ondrejov, Czech.). Bull. Astron. Inst Czech.; 26: No. 2, 65-81(1975).

Good agreement between the predicted properties of certain categories of mass-exchanging binaries and the observed properties of Be stars is demonstrated. Most of the observed spectral changes of Be stars can be explained satisfactorily as a consequence of different modes of mass transfer between components. In particular, this applies to the long-termed variations of these objects which have remained unexplained so far. It seems reasonable, therefore, to suppose that a large portion of Be stars (if not all!) are in fact interacting binaries. (auth)

20548 HYDROMAGNETIC THEORY OF SOLAR SECTORS: SLOW HYDROMAGNETIC WAVES. Suess, S. T. (National Oceanic and Atmospheric Administration, Boulder, CO). AIAA (Am. Inst. Aeronaut. Astronaut.) J.; 13: No. 4, 443-447(Apr 1975).

From AIAA fluid and plasma dynamics conference; Palo Alto, CA (17 Jun 1974).

Magnetic sectors on the sun are a feature, when the solar dipole field is subtracted, reminiscent of grapefruit sections in terms of the boundaries described by the magnetic field polarity change. One possible suggestion for the origin of these sectors is that they are hydromagnetic waves controlled by the rotation, toroidal magnetic field, and stratification within the convection zone of the sun. The merits of this suggestion are evaluated with respect to the observations and a specific theoretical model. 4 figs, 38 refs. (auth)

20549 MAGNETIC FIELD MEASUREMENTS IN XI BOOTIS A. Boesgaard, A. M. (Univ. of Hawaii, Honolulu); Chesley, D.; Preston, G. W. Publ. Astron. Soc. Pac.; 87: No. 517, 353-355 (Jun 1975).

Four Zeeman spectrograms from Lick Observatory of xi Boo A and two of iota Peg at 2 A mm^{-1} have been measured to determine if a weak magnetic field is present in xi Boo A. The results indicate that the field is too weak to be measured by this technique on these spectrograms, although remeasurements of spectrograms from Mauna Kea at 3.4 A mm^{-1} still give a positive field of 170 gauss. (auth)

20550 PHYSICAL ASSOCIATION OF THE PECULIAR EMISSION-LINE STARS HD 122669 AND HD 122691. Garrison, R. F. (Univ. of Toronto); Hiltner, W. A.; Sanduleak, N. Publ. Astron. Soc. Pac.; 87: No. 517, 369-371(Jun 1975).

Spectroscopic and photometric observations indicate a physical association between the peculiar early-type emission-line stars HD 122669 and HD 122691. The latter has undergone a drastic change in the strength of its emission lines during the past 20 years. There is some indication that both stars vary with shorter time scales. (auth)

20551 UBVRI PHOTOMETRY OF V553 CENTAURI. Landolt, A. U. Publ. Astron. Soc. Pac.; 87: No. 517, 373-377(Jun 1975).

UBVRI photoelectric observations are presented for the Population II cepheid V553 Cen. Its period of 2.06051d is confirmed. (auth)

20552 PHOTOMETRY OF V1057 CYGNI AND NEIGHBORING STARS. Landolt, A. U. Publ. Astron. Soc. Pac.; 87: No. 517, 379-383(Jun 1975).

UBV photoelectric photometry of stars in the vicinity of the pre-main-sequence object V1057 Cyg has been used to establish a photometric sequence in the magnitude range 5.5 less than V less than 15.5. Photographic and photoelectric photometry of V1057 Cyg in the time interval 1971 to 1974 also is reported. The brightness slowly declined from 1971 to 1974. (auth)

20553 TWO G GIANTS WITH STRONG CH, HR 7606 AND HR 8626. Baird, S. R.; Roberts, W. J.; Snow, T. P.; Wallerstein, G. (Univ. of Washington, Seattle). Publ. Astron. Soc. Pac.; 87: No. 517, 385-396(Jun 1975).

Two G0 stars, HR 7606 and HR 8626, are found to have greatly enhanced CH features but no enhancement of the lines of C I, C_2 is strong and CN moderately so. An abundance analysis relative to the G0 Ib star beta Aqr reveals that the two stars have a metal deficiency of about a factor of 2.5, and absolute magnitude near -2.5 and normal carbon, while the carbon abundance in beta Aqr is $\frac{1}{3}$ of the solar abundance. The lithium abundance in HR 8626 is enhanced while the lithium line in HR 7606 is not visible. Less than 10 percent of the carbon is ^{13}C and a similar limit is placed on the ratio of deuterium to hydrogen. The simplest explanation of these differences is to conclude that these stars with strong CH are evolving to the right for the first time in the H-R diagram, while the vast majority of F and G Ib stars have already been giants and have altered their surface compositions by mass loss and mixing. (auth)

20554 ORIGIN OF THE 6379 A ABSORPTION IN SC AND CS STARS. Catchpole, R. M. (South African Astronomical Observatory, Cape Town). Publ. Astron. Soc. Pac.; 87: No. 517, 397-400(Jun 1975).

The A and B bands of calcium hydride are identified at high dispersion in the SC star, UY Cen. In the SC stars, the B band is largely responsible for the lambda 6379 absorption noted by Rybski (1973). CaH is also present in the CS star TT Cen, but may not be responsible for the lambda 6379 absorption in WZ Cas. (auth)

20555 1974 PALOMAR SUPERNOVA SEARCH. Kowal, C. T.; Sargent, W. L. W.; Huchra, J. Publ. Astron. Soc. Pac.; 87: No. 517, 401-403(Jun 1975).

Five supernovae were discovered at Palomar Observatory during 1974. In addition, three supernovae were found on plates of the Palomar Sky Survey, by the late Dr. Fritz Zwicky. (auth)

20556 DISCOVERY OF HERBIG-HARO OBJECTS BY [S II] INTERFERENCE PHOTOGRAPHY. Van Den Bergh, S. (Univ. of Toronto). Publ. Astron. Soc. Pac.; 87: No. 517, 405-406(Jun 1975).

It is shown that [S II] interference filter photography is a powerful technique for the discovery of Herbig-Haro objects. (auth)

20557 NOVA PERSEI 1974. Landolt, A. U. Publ. Astron. Soc. Pac.; 87: No. 517, 407-408(Jun 1975).

UBV photometry and a finding chart are presented for Nova Persei 1974. (auth)

20558 TIMES OF MINIMA AND LIGHT CURVE FOR V382 CYGNI. Landolt, A. U. Publ. Astron. Soc. Pac.; 87: No. 517, 409-416(Jun 1975).

Five new photoelectrically determined times of minima are given for the massive, double-lined eclipsing binary V382 Cyg. UBV photoelectric observations gathered in the interval 1964-71 are tabulated. (auth)

20559 SPECTRAL TYPES IN THE OPEN CLUSTER NGC 6475. Abt, H. A. (Kitt Peak National Observatory, Tucson, AZ). Publ. Astron. Soc. Pac.; 87: No. 517, 417-419(Jun 1975).

Spectral classification of 27 of the brightest cluster members shows (1) an earliest type of B5 IV, (2) a hot Am or Sirius-type star, (3) three Ap stars of the Si or Si-Cr kind, all with weak Ca II K lines, (4) two additional stars with weak K lines, and (5) one "classical" Am star. It is noticed that among the eight spectroscopic binaries in this cluster, the ones with broad lines have normal K-line strengths whereas nearly all of those with sharp lines have weak K lines. (auth)

20560 INFRARED OBSERVATIONS OF LATE-TYPE STARS IN NEBULAE. Cohen, M. (Univ. of California, Berkeley). Publ. Astron. Soc. Pac.; 87: No. 517, 421-423(Jun 1975).

Two- to 18-mu observations of five late-type stars involved with nebulae reveal no infrared excesses near 10 mu. This fact, coupled with the presence of nebular structures resembling wakes or bow shocks, suggests that the stars have randomly encountered the nebulae. (auth)

20561 RATIO OF COLOR EXCESSES IN UBV PHOTOMETRY. Gutierrez-Moreno, A.; Moreno, H. (Univ. of Chile, Santiago). Publ. Astron. Soc. Pac.; 87: No. 517, 425-432(Jun 1975).

Numerical integrations have been performed in order to obtain the ratio of the color excesses in UBV photometry. The data were analyzed to study the dependence of this ratio and of the value of R on the color of the stars and on the reddening itself. The results show that the ratio of the color excesses is practically independent of the reddening, while R appears to change more with the spectral type than with the total amount of reddening. (auth)

20562 DISTANCE AND VELOCITIES OF M SUPERGIANTS ASSOCIATED WITH OH AND H_2O EMISSION SOURCES. Humphreys, R. M. Publ. Astron. Soc. Pac.; 87: No. 517, 433-437 (Jun 1975).

New radial velocities for S Per, PZ Cas, and VY CMa are included in a discussion of the distances and velocities of M supergiants which are also OH and H_2O emission sources. It is shown that S Per and PZ Cas are probably associated with Per OB1 and Cas OB5, respectively. The peculiar star VY CMa may be associated with NGC 2362 and tau CMa or the more distant cluster NGC 2439. The available data on the velocities and distances of these M supergiants appear to support theoretical models for the maser emission in which the true velocity of the source is at or near the center of the OH velocity structure. (auth)

20563 INFRARED OBSERVATIONS AND THE EFFECTIVE TEMPERATURE OF THE PECULIAR STAR HD 101065. Hyland, A. R. (Australian National Univ., Canberra); Mould, J. R.; Robinson, G.; Thomas, J. A. Publ. Astron. Soc. Pac.; 87: No. 517, 439-441(Jun 1975).

Infrared photometric observations of the peculiar star HD 101065 are presented. The spectral type of HD 101065 is found to be between F5 and F6 and its effective temperature to be $6300^0 +- 150^0$. (auth)

20564 MAGNETIC FIELDS IN dMe STARS: HOW EFFECTIVE IS THE BATTERY MECHANISM. Mullan, D. J. (Franklin Inst., Swarthmore, PA). Publ. Astron. Soc. Pac.; 87: No. 517, 455-459 (Jun 1975).

Although we agree with Worden (1974) that the surfaces of dMe stars may be the sites of magnetic fields as large as 1-100 kilogauss, we disagree with his conclusion that Biermann's battery mechanism is responsible for generating such large fields. We believe that it is more probable that field generation occurs in convective conditions, where the battery cannot operate efficiently. We also disagree with the argument used by Worden to relate magnetic energies with observed properties of flare stars. (auth)

20565 PERIOD VARIATION IN THE WHITE-DWARF ECLIPSING BINARY BD + $16^0$516. Young, A.; Lanning, H. H. (San Diego State Univ., CA). Publ. Astron. Soc. Pac.; 87: No. 517, 461-464 (Jun 1975).

Photometric observations of eclipse contacts over the past 4.7 years (3300 cycles) are discussed, revealing systematic variations in the period which suggest active mass transfer in progress. The period is found to have increased and decreased over this interval, and current models are not adequate to account for such variations when one component is a white dwarf. Some new and improved data for the system are also discussed. (auth)

20566 BLAZHKO EFFECT IN OBSERVATIONS OF XZ CYGNI. Smith, H. A. (Wesleyan Univ., Middletown, CT). Publ. Astron. Soc. Pac.; 87: No. 517, 465-470(Jun 1975).

An analysis was made of the Blazhko effect in the RR Lyrae star XZ Cyg using 410 times and brightnesses of primary maxima obtained between 1905 and 1973. A secondary periodicity was found to exist for XZ Cyg, the period of this variation being about 57.38d until JD2438500 (1964) and thereafter about 58.7d. Mean curves are derived for the 57.38d and 58.7d variations. It is shown that the increase in the secondary period can be explained under the assumption that the secondary period is a beat period involving interference between the primary periodicity and another periodicity. (auth)

20567 NEW MASSIVE ECLIPSING BINARY HR 6773. Young, A.; Etzel, P. (San Diego State Univ., CA). Publ. Astron. Soc. Pac.; 87: No. 517, 471-477(Jun 1975).

A light curve, velocity curve, and preliminary orbit elements and structure are presented for the early B-star eclipsing binary HR 6773. The evidence suggests that the more massive (primary) component is in early post-main-sequence evolution. Transient behavior is exhibited by the light curve which is suggestive of mass transfer activity. (auth)

20568 WAVES IN PLASMA WITH THE HALL DISPERSION. Baranov, V. B.; Ruderman, M. S. (Space Research Inst., Moscow). pp B.26.1-B.26.10 of Rarefied Gas Dynamics. Vol. I. Becker, M. (Ed.). Linder Hoehe, Ger.; DFVLR-Press (1974).

From 9th international symposium on rarefied gas dynamics; Gottingen, F.R. Germany (15 Jul 1974). See CONF-740743-P1.

A mathematical model of a rarefied plasma of outer space, e.g.

interplanetary and interstellar plasma, solar corona plasma, etc., is presented. The plasma can be described by the magnetohydrodynamic equations if Hall currents are taken into account. (BJG)

20569 ELECTROMAGNETIC RADIATION EMITTED BY CHARGED RINGS FALLING IN BLACK HOLES. Mavrides, S. (Institut Henri Poincare, Paris). Nuovo Cim.; 27B: No. 2, 323-327(11 Jun 1975).

A recent study of time-dependent accretion disks around black holes has shown that the inner region is unstable against clumping of the gas into rings. So, the electromagnetic radiation that could be emitted by charged rings falling into a black hole is examined. The process of emission of electromagnetic radiation is analyzed by a perturbation analysis in a given background metric. (auth)

20570 ON MULTIPLE SOLUTIONS IN CORE HELIUM-BURNING PHASE. Murai, T. (Nagoya Univ. (Japan). Dept. of Physics). Publ. Astron. Soc. Jap.; 26: No. 3, 323-339(Sep 1974).

Equilibrium solutions for core helium-burning stars of mass 15 $M_{\odot}$ are investigated, in order to show and to interpret the existence of three solutions in terms of the UV diagram. The roles of the Kramers opacity, of the distribution of the chemical composition, and of the outer convective region are clarified. Two solutions exist for wholly radiative envelopes, because of the spiraling behavior of envelope solutions arising from the contribution from the Kramers opacity. The extensive outer convective zone, which tends to smear out the spiraling part for less massive stars, yields one other solution for massive stars. On the basis of the behavior of solutions in the UV diagram, processes associated with the transition of a model between the red and the blue supergiant stage in the evolutionary sequence are considered. The existence of multiple solutions and the secular instability do not necessarily take part in this transition. (auth)

20571 EFFECT OF LINE BLOCKING ON THE LIGHT CURVES OF THE AP STAR HR 5355 (HD 125248). Pilachowski, C. A.; Bonsak, W. K. (Univ. of Hawaii, Honolulu). Publ. Astron. Soc. Pac.; 87: No. 516, 221-229(Apr 1975).

Line-blocking coefficients were measured from coude spectrograms covering the blue and green parts of the spectra, throughout the 9d3 cycle of HR 5355. The coefficient for the v band of the uvby photometry is found to vary through a range of 0m06 of the continuum in a double wave, with maxima corresponding to the maxima of both the Eu II and the Cr spectrum variation, which occur in antiphase. This line blocking cannot account for the strong single-wave light variation in the v band, which has a minimum at rare-earth maximum, but may be responsible, by redistribution of flux, for the double-wave character of the b- and y-band light variations. There is little variation of line blocking in the b and y bands. Line blocking varies significantly with wavelength and with phase in the vicinity of 5200 A, and is partially responsible for the minimum in the apparent continuum found by photometric observers. It does not appear to be possible to interpret the basic light variations of HR 5355 by the mechanisms recently proposed for this and other Ap stars. (auth)

20572 PHOTOMETRY OF SIX PECULIAR A-TYPE STARS. Wolff, S. C.; Morrison, N. D. (Univ. of Hawaii, Honolulu). Publ. Astron. Soc. Pac.; 87: No. 516, 231-236(Apr 1975).

Four-color (uvby) photoelectric observations are presented for six Ap stars. No variations were found for the Hg-Mn star kappa Cnc. The periods of 1d4450 for 45 Leo and 2d8881 for HR 5597 found by Winzer (1974) are confirmed. The period of HR 5153 is shown to be 2d451. Possible explanations for the photometric variations of 56 Ari and HR 4369 are discussed. (auth)

20573 SYSTEMIC VELOCITY OF BETA LYRAE. Batten, A. H.; Fletcher, J. M. (Dominion Astrophysical Observatory, Victoria, Canada). Publ. Astron. Soc. Pac.; 87: No. 516, 237-244(Apr 1975).

Radial velocities of beta Lyr determined at Victoria from 1966 to 1974 are all well satisfied by an assumed circular orbit with V_0 equals -17.8 km sec^{-1} +- 0.8 km sec^{-1}, and K_1 equals 184.0 km sec^{-1} +- 0.7 km sec^{-1}, provided account is taken of the changing period in the calculation of phases, and the velocity measurements are made only from the lines of Si II. Previous work indicating variations in the value of V_0 is discussed. The use of unreliable lines for velocity measurement, small systematic differences between spectrographs, and possible occasional distortion of the velocity curve can account for the variations reported. (auth)

20574 SPECTROSCOPY OF THE MASSIVE ECLIPSING BINARY HD 163181 (equals V453 SCORPII). Hutchings, J. B. (Dominion Astrophysical Observatory, Victoria, Canada). Publ. Astron. Soc. Pac.; 87: No. 516, 245-251(Apr 1975).

New coude spectrograms of the OB binary HD 163181 are analyzed. An absorption spectrum attributed to the secondary is reported for the first time, and it is deduced that the secondary is more massive and less luminous than the supergiant primary. The primary shows phase-dependent mass-loss characteristics and the present light curve suggests that it is near its Roche limiting radius. Nitrogen and oxygen abundances are unusual in the primary spectrum. The nature of the secondary is discussed. (auth)

20575 RADIAL VELOCITY VARIATION OF THE K GIANT HD 107325. Bolton, C. T. (Univ. of Toronto); Young, A.; Wicks, G.; Jones, R. B. Publ. Astron. Soc. Pac.; 87: No. 516, 259-264(Apr 1975).

New spectroscopic observations of the K giant HD 107325 from three observatories are reported. These observations, which extend from 1970 February to 1974 June, rule out the large-amplitude velocity variations of one-half day period that were reported by Fehrenbach, but suggest that a small-amplitude long-period velocity variation is present. The old observations are rediscussed. (auth)

20576 VRI PHOTOMETRY OF THE RECURRENT NOVA V1017 SAGITTARII. Landolt, A. U. (Louisiana State Univ., Baton Rouge). Publ. Astron. Soc. Pac.; 87: No. 516, 265-267 (Apr 1975).

VRI photometric observations of V 1017 Sgr in 1973 and 1974 are discussed. (auth)

20577 REALITY OF THE SPECTROSCOPIC ORBIT FOR R AQUARII. Jacobsen, T. S.; Wallerstein, G. (Univ. of Washington, Seattle). Publ. Astron. Soc. Pac.; 87: No. 516, 269-271(Apr 1975).

New velocities for the emission lines in R Aqr show that the system has not followed the orbit with a period of 26.7 years tentatively suggested by Merrill. The binary nature of the star and its enormous mass function of 16.5 solar mass are probably unreal. Evidence for mass loss with ionization and velocity increasing outward is presented. (auth)

20578 REVISED ORBIT FOR HR 5361. Scarfe, C. D.; Alers, S. (Univ. of Victoria, Canada). Publ. Astron. Soc. Pac.; 87: No. 516, 285-288(Apr 1975).

Radial velocities from 26 coude spectrograms and from five coude scanner observations have been used to redetermine the elements of this single-line K-giant binary. (auth)

20579 BEHAVIOR OF LAMBDA 2800 Mg II IN STELLAR SPECTRA. Gurzadyan, G. A. (Garny Space Astronomy Lab., Erevan). Publ. Astron. Soc. Pac.; 87: No. 516, 289-299(Apr 1975).

The results of measurements of the equivalent widths of the resonance doublet of ionized magnesium lambda 2800 Mg II in the spectra of 51 relatively faint stars, up to 10/sup m/, of the spectral classes B1-K5 are presented. The observed material has been obtained by means of the space observatory "Orion-2". Some regularities in the behavior of lambda 2800 Mg II in stellar spectra have been revealed: wide and deep depression of the continuous spectra at 2800 A in F-G type stars; the presence of the doublet lambda 2800 Mg II in the form of weak emission in the spectra of cold stars (K2-K5); the presence both of the multiplet lambda 3080 Ti II and the doublet lambda 2800 Mg II simultaneously either in emission--in the late-type stars--or in absorption in earlier types; the existence of combined profiles of lambda 2800 Mg II, i.e., a wide absorption line with a weak emission in the center, in stars of the transitional class (G5-K0), etc. A well-defined empirical relationship between the equivalent width of lambda 2800 Mg II and the spectral class of the star has been established. (auth)

20580 LINEAR POLARIZATION OF THE WHITE-DWARF BINARY BD + 16^{0}516. Kemp, J. C.; Rudy, R. J. (Univ. of Oregon, Corvallis). Publ. Astron. Soc. Pac.; 87: No. 516, 301-303(Apr 1975).

The eclipsing white-dwarf binary BD + 16^{0}516 has been found to have a small but finite linear polarization, p approximately equal to 0.15 percent, theta approximately equal to 50^{0}, as averaged over orbital phase and wavelength. While this is probably interstellar, there is also marginal evidence for a component in the ultraviolet which varies with phase. Further work is needed. (auth)

20581 AZ CASSIOPEIAE AT THE 1956-57 ECLIPSE. Mendez, R. H. (Inst. de Astronomia y Fisica del Espacio, Buenos Aires); Muench, G.; Sahade, J. Publ. Astron. Soc. Pac.; 87: No. 516, 305-310(Apr 1975).

The spectrum of AZ Cas at the time of the 1956-57 eclipse can be described as a combination of an F8 Ib star and a main-sequence B0-1 companion. The latter star is ejecting matter with approximately spherical symmetry at some 50-60 km sec^{-1}, while the former has a very extended atmosphere. The whole system seems to be also surrounded by an expanding envelope. Determinations of the spectral type of the red companion range from early-M, well before eclipse, to F8, in our material, with a Ib-luminosity class sensibly constant. This variation is interpreted as indicating changes in the optical thickness of the envelope surrounding the late-type companion, either intrinsic (rho Cas episode) or related to the binary nature of the system. (auth)

20582 H BETA AND CONTINUUM PHOTOMETRY OF BW VULPECULAE. Cherewick, T. A.; Young, A. (San Diego State Univ., CA). Publ. Astron. Soc. Pac.; 87: No. 516, 311-316(Apr 1975).

The beta CMa star BW Vul was observed in the Stroemgren violet color, and an H beta index was observed to search for variations which might correlate with the continuum radiation, and to note any changes in the equivalent width of the H beta line which might indicate pressure changes. We observed no variation and no correlation of the H beta index with the phase (contrary to the findings of Kubiak (1971)). A new period study confirms a systematic increase in period. (auth)

20583 INFRARED LIGHT CURVES FOR V1057 CYGNI (1971–74). Simon, T. (Univ. of Hawaii, Honolulu). Publ. Astron. Soc. Pac.; 87: No. 516, 317-320(Apr 1975).

Broadband infrared photometry at 5 mu, 10 mu, and 20 mu is presented for V1057 Cyg (equals LkH alpha 190). The observations extend from 1971 July through 1974 July, during which time the 5 mu brightness has remained essentially constant and the long-wavelength fluxes have decreased by approximately 0m8. The origin of the flux excess observed at wavelengths between 1 mu and 5 mu is uncertain; remnant circumstellar dust, which is radiatively heated by a central point source of declining luminosity, provides a satisfactory explanation of the 10 mu and 20 mu light curves. (auth)

20584 ELEMENT ABUNDANCES IN ALGOL-TYPE BINARIES. Naftilan, S. A. (Case Western Reserve Univ., Cleveland). Publ. Astron. Soc. Pac.; 87: No. 516, 321-326(Apr 1975).

The results of an abundance analysis of both the primaries and secondaries of six eclipsing binary stars are presented. The analysis was done by adjusting the parameters used to generate synthetic spectra until the best fit with the observed spectra was obtained. The secondaries of three "classical" Algol-type binaries, U Cep, TT Hya, and ZZ Cnc, were found to be very slightly metal deficient in agreement with photometric results. The subgiant secondaries of RS CVn and RW UMa, which do not fill their Roche lobes, are found to be moderately metal deficient. The secondary of the widely separated supergiant system, RZ Oph, shows no metal deficiency. All of the primaries are either normal or very slightly metal rich. Several theories of binary-star evolution are considered, but none explain these results satisfactorily. (auth)

20585 DOUBLE-LINE SPECTROSCOPIC BINARY HD 159176. Conti, P. S. (Univ. of Colorado, Boulder); Cowley, A. P.; Johnson, G. B. Publ. Astron. Soc. Pac.; 87: No. 516, 327-332(Apr 1975).

From coude observations at Kitt Peak and Cerro Tololo we derive the orbital elements of the system HD 159176. Both stars are practically identical 07 stars, each already evolved from the ZAMS. The close separation, probable synchronous rotation, and near filling of their Roche lobes suggest photometric variability will be observable. Eclipses are unlikely. (auth)

20586 OPTICAL POLARIZATION OF A HERBIG–HARO OBJECT IN CORONA AUSTRINA. Vrba, F. J.; Strom, S. E.; Strom, K. M. (Univ. of Arizona, Tucson). Publ. Astron. Soc. Pac.; 87: No. 516, 337-339(Apr 1975).

Optical polarization measurements suggest that H-H 100 in the CrA dark cloud represents a reflection nebula illuminated by the infrared source discovered by Strom, Strom, and Grasdalen (1974). (auth)

20587 PHOTOMETRY OF A BRIGHT FILAMENT IN THE ORION NEBULA. Dufour, R. J.; Mathis, J. S. (Univ. of Wisconsin, Madison). Publ. Astron. Soc. Pac.; 87: No. 516, 345-348 (Apr 1975).

The spectrum of a bright filament in the outer portion of the Orion nebula, 14' from the Trapezium, was studied. The temperature of the filament, derived from [N II] lambda lambda 5755/6583 ratio, is 9560°K. The electron density (from [S II] lambda lambda 6717, 6731) is low: 360 ± 150 cm^{-3}. The ionic abundances of He^{+}, N^{+}, O^{++}, and S^{-} are about the same as Peimbert and Costero (1969) found in regions in Orion closer to the Trapezium. We conclude that the filament is photoionized, presumably by the Trapezium, rather than a shock front, as had originally been suspected. (auth)

20588 UNUSUAL MAGNETIC ACTIVITY DURING 4 TO 10 AUGUST 1972 AND SOME OF ITS BIOLOGICAL CONSEQUENCES. Srivastava, B. J.; Bhaskara Rao, D. S. (National Geophysical Research Inst., Hyderabad, India). Indian J. Radio Space Phys.; 3: No. 4, 384-390(Dec 1974).

Analysis and discussion of the unusual magnetic activity observed at Hyderabad during 4-10 August 1972 are presented. The three major SC-type magnetic storms recorded during the period in association with important solar flares are discussed. The second storm which was characterized by a large SC amplitude (99γ in H) at 2054 hrs UT on 4 August, and numerous rapid oscillations throughout, is compared with the great magnetic storm of 17 July 1959. The estimated velocities of the solar wind responsible for these storms are also compared with the velocities actually observed by Pioneer-9. Some of the biological consequences of these magnetic storms at Hyderabad are also examined. It is found that during this period the number of admissions of heart cases and general sickness cases as well as deaths in the hospitals at Hyderabad registered a significant increase. Road accidents in Hyderabad also showed an increase. It is argued that the enhanced micropulsations and other rapid oscillations of the geomagnetic field occurring during magnetic storms trigger off such biological consequences after reacting with the human brain and heart. 4 tables, 2 figs, 3 refs. (auth)

20589 ORIENTATION OF PLANETARY NEBULAE WITHIN THE GALAXY. Melnick, G.; Harwit, M. (Cornell Univ., Ithaca, NY). Mon. Not. R. Astron. Soc.; 171: No. 2, 441-444(May 1975).

Planetary nebulae shown in the catalogue of Perek & Kohoutek have been analyzed. It is found that, among elliptical planetaries, there is a correlation between the orientation of the major axis of the planetary nebula and the direction of the Galactic equator. In those planetaries exhibiting pronounced bipolar structure, it is found that the axis passing through the regions of enhanced brightness is perpendicular to the major axis, and also to the Galactic equator. (auth)

20590 PHOTOMETRY OF SK160 = SMC-X1. Penfold, J. E.; Warren, P. R.; Penny, A. J. Mon. Not. R. Astron. Soc.; 171: No. 2, 445-455(May 1975).

Photometry on the UBV system is presented for the SMC Bo I star SK 160 which is now identified with the X-ray source SMC-X1. A simple rotating ellipsoid model is shown to be insufficient to represent the data. (auth)

20591 CONTINUUM FLUX DISTRIBUTION FOR ARCTURUS. Blackwell, D. E.; Ellis, R. S.; Ibbetson, P. A.; Petford, A. D.; Willis, R. B. (Oxford Univ., Eng.). Mon. Not. R. Astron. Soc.; 171: No. 2, 425-439(May 1975).

A composite of all continuum flux data for Arcturus has been plotted including additional results obtained recently in Israel. The data are compared with flux distributions calculated from Carbon & Gingerich, and Peytremann grids of models. There is not good agreement between the calculated and observed flux distributions at shorter wavelengths, but the Peytremann model seems considerably better than the Carbon & Gingerich model. The origin of the discrepancy is discussed and a compromise value of $T_e = 4500\ K^{\circ}{}^{+100}_{-150}$ suggested. The need for accurate spectrophotometry and improved model atmosphere is stressed. (auth)

20592 MONOCHROMATIC ISOPHOTOMETRY OF PLANETARY NEBULAE. I. Hβ Observations of NGC 6210, 6543, 6826, 7009, 7027, and 7662. Coleman, C. I.; Reay, N. K.; Worswick, S. P. (Imperial Coll. of Science and Tech., London). Mon. Not. R. Astron. Soc.; 171: No. 2, 415-423(May 1975).

The spectracon electronographic detector, with its advantages over photography of large dynamic range, linearity and high detective quantum efficiency, is used in a program of monochromatic surface photometry of planetary nebulae. The instrumentation and data reduction techniques are described. Data in the form of Hβ (λ4861 Å) isophote maps are presented for NGC 6210, 6543, 6826, 7009, 7027 and 7662. Each object is discussed with particular reference to faint outer envelopes and maximum overall dimensions. (auth)

20593 PHOTOELECTRIC RADIAL VELOCITIES, PAPER 6 HEARD'S IAU STANDARD STARS. Griffin, R. F. (Cambridge Univ., Eng.). Mon. Not. R. Astron. Soc.; 171: No. 2, 407-414 (May 1975).

Fourteen of the 24 "ninth-magnitude" radial-velocity standards proposed by Heard have been observed. One of them is shown to vary in velocity, in addition to two already rejected by Heard for the same reason. The photoelectric observations give accidental errors substantially smaller than those of the published standard velocities. Criteria appropriate to the selection and adoption of future standard stars are suggested. (auth)

20594 SPECTROSCOPIC BINARY SYSTEM HD 158320 (= 3U 1727-33). Penny, A. J. (Royal Greenwich Observatory, Hailsham, Eng.); Penfold, J. E.; Baiona, L. A. Mon. Not. R. Astron. Soc.; 171: No. 2, 387-393(May 1975).

HD 158320 has been studied spectroscopically and photometrically. It is shown to be a B 0.5 II spectroscopic binary of 38.10 day period, with a companion of minimum mass 1.7 $M_{\odot}$, and to be a member of a physical visual triple system. No photometric variations are found. It is a possible candidate for the X-ray source 3 U 1727-33. (auth)

20595 Hβ PHOTOMETRY OF SOUTHERN EARLY-TYPE STARS AND GALACTIC STRUCTURE AWAY FROM THE PLANE. Kilkenny, D.; Hill, P. W. (Saint Andrews Univ., Eng.). Mon. Not. R. Astron. Soc.; 171: No. 2, 353-374(May 1975).

Hβ photoelectric photometry is reported for 165 early-type stars at intermediate and high galactic latitudes. The data are combined with earlier UBV and spectroscopic results to determine the stellar space distribution. Stars of type B2 and earlier, at distances of up to 1 kpc from the galactic plane, appear to follow spiral structure in the plane. The available material, particularly the derived color excesses, is used to select a number of blue stars which may be subluminous. (auth)

20596 ULTRAVIOLET OBSERVATIONS OF HD 77581 (= 2U 0900-40). Nandy, K.; Napier, W. McD.; Thompson, G. I. (Royal Observatory, Edinburgh). Mon. Not. R. Astron. Soc.; 171: No. 2, 259-262(May 1975).

The absolute flux distribution in the spectral range from 1350 Å to 2740 Å of HD 77581 is presented here. The companion of this star is the X-ray source 2U 0900-40. The ultraviolet spectrum has been obtained with the S2/68 Ultraviolet Sky Survey telescope in the TD1 satellite. Its flux distribution, corrected for interstellar reddening determined from the observed ultraviolet color (m_{2190}-m_{2360}), is found to be similar to that of a Bo supergiant star, ε Ori (HD 37128). (auth)

20597 X-RAY, OPTICAL AND RADIO PROPERTIES OF YOUNG SUPERNOVA REMNANTS. Gull, S. F. (Mullard Radio Astronomy Observatory, Cambridge). Mon. Not. R. Astron. Soc.; 171: No. 2, 263-278(May 1975).

The expansion of hot gas spheres into a cold uniform medium is studied as a model for the evolution of young supernova remnants. The formation of fast optical filaments in a young supernova is attributed to a Rayleigh-Taylor instability as the expanding sphere sweeps up interstellar material. In the expansion, energy is stored in the velocity dispersion of the ejecta and this is made available in the form of internal energy and random motions as the remnant decelerates. During the process of filament formation, the ejecta are re-heated to a high temperature as they coalesce to form a thin shell. The thermal X-ray emission of this hot gas can account for the observed X-ray luminosity of Cas A. Secondary instabilities as the filaments disperse provide a natural way of producing a shell of magnetic field in young remnants. It appears that many of the properties of young supernova remnants can be attributed to liberation of this energy stored in the velocity dispersion of the ejecta. (auth)

20598 ROLE OF MAGNETIC FORCES IN SUNSPOT EQUILIBRIUM. Adam, M. G. (Oxford Univ., Eng.). Mon. Not. R. Astron. Soc.; 171: No. 2, 287-302(May 1975).

Detailed measurements have been made to determine the configuration of the magnetic field over a large sunspot, using the Oxford 35-m solar telescope and the 11-m spectroscope. The heliographic direction of the magnetic vector and the field strength have been derived, for more than 200 points specified by solar latitude and longitude, from measurements of Zeeman split lines in the λ 5250 Å region. Treanor's method has been used to obtain the magnetic field directions. The field strength observations show that the isogauss lines, in this somewhat irregular spot, run for the most part parallel to the umbra-penumbra boundary. The magnetic field lines in stable regions of the spot are found to be untwisted and lie in planes perpendicular to the isogauss lines. The horizontal forces in stable regions of sunspots are briefly discussed using the "magnetic line curvature" approach developed by Jakimiec. The results obtained from precise measurements imply that the magnetic field, at least in the penumbra, cannot be force-free, and some estimate is made of the magnetic field contribution to the horizontal forces between the umbra and the photosphere. (auth)

20599 LARGE SCALE MAGNETIC FIELDS IN LATE-TYPE STARS. Moss, D. L. (Helsinki Univ., Finland). Mon. Not. R. Astron. Soc.; 171: No. 2, 303-309(May 1975).

Models of a late-type zero age main sequence star with a deep surface convection zone are constructed containing a large scale dipolar magnetic field which is assumed to be expelled from the envelope by the action of the turbulence. It is shown that there must be a discontinuity in the transverse component of field at the lower boundary of the envelope, and that for the model considered it is unlikely that the central field can exceed about 10^7 Gauss. (auth)

20600 DYNAMICAL INSTABILITIES AND MASS EXCHANGE IN BINARY SYSTEMS. Bath, G. T. (Oxford Univ., Eng.). Mon. Not. R. Astron. Soc.; 171: No. 2, 311-328(May 1975).

A hydrodynamic scheme is presented by means of which the dynamical behavior of stars transferring mass in semidetached binary systems may be investigated. Cool stellar envelopes are found to be dynamically unstable when in contact with the Roche lobe, but only so long as the recombination energy is sufficient to overcome the gravitational potential change to the surface. Such unstable states are followed by phases in which the photosphere shrinks inside the Roche lobe, readjusting to thermal equilibrium. The quasi-periodic mass transfer that results is suggested as being responsible for dwarf nova eruptions, and may be of importance in X-ray sources, Algol systems, and binary symbiotic variables. (auth)

20601 RADIO REMNANT OF KEPLER'S SUPERNOVA. Gull, S. F. (Mullard Radio Astronomy Observatory, Cambridge). Mon. Not. R. Astron. Soc.; 171: No. 2, 237-242(May 1975).

A high-resolution radio map of Kepler's SNR has been constructed from 5 GHz observations made at Cambridge and at Owens Valley. The remnant is shown to have an irregular shell structure of 170″ arc diameter, which is brightest in the north, with a gap at the south and a peculiar dent to the east. The patches of diffuse emission that comprise the optical remnant are largely concentrated in the brightest parts, but they are expanding much more slowly than the average shell velocity. The remnant has a close resemblance to Tycho's SNR, but is rather more irregular. (auth)

20602 ATLAS OF PROFILES OF INTERSTELLAR CALCIUM AND HYDROGEN LINES. Beintema, D. A. Groningen; Rijksuniversiteit (10 Mar 1975). 83p.

Thesis.

Detailed results of a study of interstellar absorption in the Ca^+ K and H lines, based on high-dispersion spectra of 149 stars, mostly concentrated in the Orion, Scorpius and Lacerta associations are given. In an Atlas, K- and H- line profiles from 113 stars are shown. These include all those in which interstellar absorption was detected. 21-cm profiles of neutral hydrogen measured in the direction of the stars are added. An analysis is given of the observed K-profiles in terms of components, listed by their velocities and equivalent widths. Where no interstellar absorption was detected, upper limits are provided. The velocity resolution of the absorption profiles is about 3 km/s (46 stars), 5 km/s (54 stars), or 9 km/s (39 stars). Uncertainties in the listed velocities and equivalent widths are larger due to grain noise, to ambiguity of interpretation, and to photographic effects. The equivalent widths probably contain a systematic error caused by a stray light level of about 1%. (NL)

20603 UV INTERSTELLAR ABSORPTION LINES IN THE SPECTRUM OF ZETA PUP. de Boer, K. S. (Rijksuniversiteit, Groningen, Netherlands); Pottasch, S. R.; Hoekstra, R.; van der Hucht, K. A.; Kamperman, T. M.; Lamers, H. J. pp 9-10 of Interstellar Absorption Lines in the Ultraviolet. de Boer, K. S. (ed.). Groningen; Rijksuniversiteit (20 Dec 1974).

Interstellar absorption lines have been detected in the spectrum of the O5 star ζ Pup. They are due to the resonance lines of Mg II λ 2803, 2796, Mg I λ 2852, Fe II λ 2586 and Mn II λ 2576, and possibly Fe I λ 2522. (NL)

Quasi-Stellar, Radio, and X-Ray Sources

Refer also to abstracts 19530, 20531, 20534, 20590, 20601, 20678, 20680, 20692, 20694, 20697, and 20706.

20604 (AD/A-001633) CORRELATION BETWEEN INFRARED AND MICROWAVE EMISSION ON THE CELESTIAL SPHERE. Final Report, 1 July 1972–1 January 1973. Dennison, B. K.; Rudzki, J. E. Jr. (Air Force Avionics Lab., Wright-Patterson AFB, Ohio (USA)). Sep 1974. 26p. (AFAL-TR-74-285). NTIS $3.75.

A summary of the known correlations of infrared and microwave emission on the celestial sphere is presented. It is concluded that at the present time, microwave observations of oh/ir stars could be used to predict their infrared fluxes. (GRA)

20605 (N-74-31322) PHYSICAL PARAMETERS OF THE CEN X-3 SYSTEM. Osmer, P. S.; Hiltner, W. A.; Whelan, J. A. J. (Cerro Tololo Inter-American Observatory, La Serena (Chile)). 1974. 10p. (NASA-CR-139569). NTIS $4.00.

Photographic spectra of Cen X-3 show that the primary star has a spectral type near O6.5 with weak, variable emission at wavelength 4640 and 4686. No orbital motion of the emission or absorption lines is detected; for the latter the upper limit is approximately + or −50 km/s. Analysis of the available data indicates that the primary is a factor of 2-3 less massive than expected from normal evolutionary models while the X-ray source has a solar mass near 1.5. (auth)

20606 (N-74-33254) STUDY OF X-RAY EMISSION FROM GALACTIC AND EXTRAGALACTIC SOURCES WITH EMPHASIS ON SOFT AND ULTRA-SOFT WAVELENGTHS. Annual Report, 1 Jun 1973–31 May 1974. Bowyer, C. S.; Lampton, M.; Cruddace, R. G.; Paresce, F. (California Univ., Berkeley (USA). Space Sciences Lab.). Aug 1974. 16p. (NASA-CR-139686). NTIS $4.00.

A Black Brant VC rocket was used to scan the Coma and Virgo clusters in order to measure structure in the x-ray sources. The rocket also made measurements of soft x-ray spectra, soft x-ray background flux during a 50 deg scan of the sky, soft x-rays from De Voucouleurs 50, set limits to the energy dependence of soft x-ray background spectra, and the flux of solar 584 A radiation resonantly scattered by interstellar He flowing through the solar system. (auth)

20607 (N-74-33272) STUDY OF OPTICAL PROPERTIES OF X-RAY SOURCES. Semiannual Report, 1 Jan–31 Aug 1974. VandenBout, P. A. (Texas Univ., Austin (USA)). 31 Aug 1974. 5p. (NASA-CR-140017). NTIS $4.00.

X-ray sources are reported for HZ Herculis, supergiant primary x-ray binary systems, and Cyg X-3. Also reported is an analysis of earlier optical and x-ray observations, along with optical coverage of the 1974 lunar occultation of the Crab Nebula. (STAR)

20608 COMPACT COMPONENTS IN EXTRAGALACTIC RADIO SOURCES. Braccesi, A. (Inst. of Physics, Bologna). Soc. Astron. Ital., Mem.; 44: S251-S269(1974). (In Italian).

Review of spectral and interferometric studies of extragalactic radio sources with compact components of variable absorption capacity. A description is given of a model proposed by Van der Laan (1966) for the radio emission to be expected from a relativistic-electron cloud subjected to adiabatic expansion at a non-relativistic velocity. However, this model suffers from the defect that a large part of the electron energy would have to be dissipated through the inverse Compton effect. This problem is reduced to some extent by the use of models in which the expansion of the plasma cloud occurs at a relativistic velocity. Turning to the results of very-long-baseline interferometric studies, two geometrical models proposed by Cavaliere et al. (1971) are discussed which use the concept of a spherical envelope to explain the observed radio emission. Finally, a correct formulation of the problem of variable source components is asserted to have been given by Kellermann et al. (1971). (IAA)

20609 SOURCE NUMBER AS A FUNCTION OF THE FLUX AND THE V/V_m METHOD IN THE INVESTIGATION OF THE EVOLUTION OF QUASISTELLAR RADIO SOURCES. Terebizh, V. Yu. Astrophysics.; 9: No. 2, 118-124(1973).

Translated from Astrofizika; 9: No. 2, 209-219(1973).

Exact expressions describing the distribution of V/V_m for quasistellar radio sources are obtained for an arbitrary nature of their evolution. A quantitative characteristic of the relation between the N–S and V/V_m methods is found. There is a strong connection between these methods. Arguments are adduced in favor of an evolution in the density of quasistellar radio sources based on an analysis of the distribution of these objects in the luminosity against redshift plot. (auth)

20610 EXTRAGALACTIC X-RAY SOURCES. Kwast, T. (Obserwatorium Astronomiczne Uniwersytetu, Warsaw). Postepy Astron.; 23: No. 1, 55-60(1975). (In Polish).

The Uhuru catalogue of X-ray sources is shortly described. The basic features of some extragalactic X-ray sources are given and three mechanisms of generation of X-rays are discussed. More detailed observations are necessary to decide which process dominates in any given source. (auth)

20611 LOW FREQUENCY VARIABILITY OF BL Lac. Stannard, D.; Treverton, A. M.; Porcas, R. W.; Davis, R. J. (Nuffield Radio Astronomy Labs., Jodrell Bank, Eng.). Nature (London).; 255: No. 5507, 384-385(29 May 1975).

Observations are described of the variability of BL Lac at relatively long radio wavelengths; these were in serious conflict with models proposed by Van der Laan (Nature 211:1131 (1966)) and by Ozernoy and Sazonov (Astrophys. Space Sci. 3:395 (1969)) which fitted variations at short wavelengths. The observations were made at Jodrell Bank at λ74 cm and λ31 cm between July 1969 and December 1974, using short and long baseline interferometers. Considerable variations were observed. It appears that the activity of BL Lac can be well represented by a succession of discrete outbursts superimposed on some relatively stable "quiescent" level. Values were assigned to the "quiescent" and active components between λ1.9 and λ74 cm, the spectra of which are shown. The marked difference in the spectral characteristics supports the view that the "quiescent" component may be associated with a discrete non-variable component of the source. (UK)

20612 ABSORPTION OF SOFT X RAYS BY MATERIAL WITHIN GOULD'S BELT. Rapley, C. G. (Mullard Space Science Lab., Dorking, Eng.). Nature (London).; 225: No. 5503, 41-42 (1 May 1975).

From the discussion presented it is concluded that it seems likely that a study of the effects of soft x-ray absorption by material in the Gould's Belt will contribute significantly to an understanding of the galactic sources of diffuse soft x-ray emission and may allow the uncertainty concerning the existence of an extragalactic component of the flux to be resolved. (UK)

20613 RADIO PROPERTIES OF BL LAC TYPE OBJECTS. Altschuler, D. R; Wardle, J. F. C. (Brandeis Univ., Waltham, MA). Nature (London).; 225: No. 5506, 306-310(22 May 1975).

New radio observations of nine BL Lac type objects are discussed. It is shown that in their radio properties these objects range from high variable sources with a strong centimetre excess to non-variable sources with comparatively steep spectra. All the evidence strongly suggests that the most variable BL Lac type objects are extremely young. (auth)

20614 THE SURROUNDINGS OF PULSARS. Schoenhardt, R. E. (Bonn Univ. (F. R. Germany). Inst. fuer Astrophysik und Extraterrestrische Forschung). Astron. Astrophys.; 35: No. 1, 13-16(1974).

Maps of the surroundings of 6 pulsars near the galactic plane, based on observations at a wavelength of 11 cm, are presented. The new results are discussed together with previous observations of 19 areas around pulsars. The galactic non-thermal shell source G 55.7 + 3.4 at the position of the pulsar PSR 1,919 + 21 is found to be an exceptional case among the 25 observed fields and is interpreted as a distant supernova remnant, not physically associated with the pulsar. The absence of any observed radio continuum radiation from the surroundings of pulsars — possibly except for the case of the pulsar PSR 0,611 + 22 — suggests that the relativistic particles, which are commonly assumed to be produced by pulsars, manage to escape very rapidly into the interstellar medium. (auth)

20615 PHYSICAL PROPERTIES OF THE HOT PLASMA OF SCO X-1. Hayakawa, S.; Kasahara, I. (Nagoya Univ. (Japan). Dept. of Physics); Matsuoka, M. Publ. Astron. Soc. Jap.; 26: No. 3, 309-322(Sep 1974).

The values of plasma parameters that characterize Sco X-1 are derived on the basis of simultaneous hard X-ray and optical observations and of theories of photon transport in a hot plasma. The fluxes of optical radiation and hard X-rays are represented as functions of the optical depth for electron scattering and the electron density for an assumed distance of Sco X-1. Their values in a quiescent bright period are (9-10) and (3-4) × 10^{16} cm^{-3}, respectively. The optical depth for electron scattering and the plasma mass increase for flare states by about 10% and about 20%, respectively, whereas the plasma temperature does not appreciably change. A hot plasma may be maintained by a mass flow from the stellar surface, and flare activity is accounted for in terms of an increase of the mass flow. (auth)

20616 X RAY ASTRONOMY. Boyd, R. L. F. (Mullard Space Science Lab., Dorking, Eng.). Electron. Power.; 21: No. 9, 554-556(15 May 1975).

X ray astronomy has been given fresh impetus in recent weeks with the success of the Ariel 5 satellite. Although only a relatively new branch of science, the study of cosmic X rays has led to the acquisition of important information concerning previously unexplained cosmological phenomena. (auth)

20617 PSR 1911 + 03: A NEW PULSAR WITH A LARGE DUTY-CYCLE. Mohanty, D. K.; Balasubramanian, V. (Tata Inst. of Fundamental Research, Bombay). Mon. Not. R. Astron. Soc.; 171: No. 2, 17P-18P(May 1975).

A new pulsar with a duty-cycle of about 21 per cent has been detected at 327 MHz using the Ooty radio telescope. In this letter the observations of the pulsar are reported and the implications of its large duty-cycle for Sturrock's polar-cap model are discussed. (auth)

20618 LUNAR OCCULTATION OF THE HARD X-RAY SOURCE IN THE CRAB NEBULA. Fukada, Y. (Nagoya Univ., Japan); Kasahara, I.; Hayakawa, S.; Makino, F.; Tanaka, Y.; Akiyama, H.; Hishimura, J.; Matsuoka, M.; Oda, M.; Nakagawa, M.; Sakurai, H.; Iyengar, V. S.; Manchanda, R. K.; Kunte, P. K.; Sreekantan, B. V. Nature (London).; 255: No. 5508, 465-466(5 Jun 1975).

Some observations on hard x-rays from the Crab Nebula at a lunar occultation on 24 January 1975 are reported, made with scintillation counters carried by a balloon launched from Hyderabad. Counting rates were observed both before and during the occultation. The observed data were fitted to a model that assumes two essentially line sources, with the pulsar in between. The average energy of the hard x-rays was ~50 keV, agreeing with MIT experiments. (UK)

20619 OBSERVATION OF COSMIC X-RAY SOURCES WITH THE DUTCH SATELLITE ANS. Brinkman, A. C.; Heise, J.; de Jager, C. (State Univ., Utrecht). Ned. Tijdschr. Natuurkd.; 34: No. 3, 71-88(1974). (In Dutch).

An instrument designed to measure soft X-rays from cosmic

sources, for operation in the Dutch satellite ANS, is described. Proportional counters with thin plastic windows are used as detectors for X-rays in the wavelength region between 0.2 and 7.0 nm. The gain of the detectors is checked indirectly in flight, with the aid of a reference proportional counter which is irradiated by a radioactive source. A short description is given of another instrument, also used in ANS, to measure hard X-radiation in the energy range between I and 40 KeV. A review is given of measured cosmic X-sources. (NL)

20620 VARIABILITY AND CIRCULAR POLARISATION IN THE NUCLEUS OF NGC5128 AT 10.7 GHz. Price, K. M.; Stull, M. A. (Stanford Univ., CA). Nature (London).; 255: No. 5508, 467-468(5 Jun 1975).

The galaxy NGC5128 (Centaurus A) is the nearest of the known strong radio galaxies and has been found to contain a remarkable compact radio source in its nucleus. It was thought that the observations described might help to elucidate the physical processes that produce such objects, and the reported results are stated to place important constraints on structure and magnetic field strength. The nucleus of NGC5128 was observed in May 1974 and January 1975, using the Stanford University five element radiotelescope. In addition to 10.7 GHz flux density measurements attempts were made to detect circular polarisation. No such circular polarisation was detected. It is thought that the nucleus of NGC5128 is probably variable at 10.7 GHz, but that the time scale for this variability may be significantly longer than reported at mm wavelengths. Models are discussed. (UK)

20621 RADIO BRIGHTNESS DISTRIBUTION OF 3C273. Conway, R. G.; Stannard, D. (Nuffield Radio Astronomy Labs., Jodrell Bank, Eng.). Nature (London).; 255: No. 5506, 310-312 (22 May 1975).

Radio brightness observations of 3C273 made by the authors and others using radio-linked interferometers based on Jodrell Bank were assembled and examined, and detailed information on the radio brightness distribution is given and discussed. (UK)

20622 GALACTIC AND EXTRA-GALACTIC RADIO ASTRONOMY. Verschuur, G. L.; Kellermann, K. I. (eds.). New York; Springer-Verlag (1974). 409p. $37.80.

The basic fields of research concerned with radio astronomy outside the solar system are outlined in separate chapters which survey the current research in each field with emphasis on the available observational data and its interpretation. They include galactic nonthermal continuum emission, interstellar neutral hydrogen and its small-scale structure, the radio characteristics of HII regions and the diffuse thermal background, the large-scale distribution of neutral hydrogen in the galaxy, supernova remnants, pulsars, radio stars, the Galactic magnetic field, interstellar molecules, interferometry and aperture synthesis, mapping neutral hydrogen in external galaxies, radio galaxies and quasars, and cosmology. (IAA)

For abstracts of individual chapters see: 20623, 20697–20706, and 20721.

20623 RADIO STARS. Hjellming, R. M. (National Radio Astronomy Observatory, Green Bank, WVA). pp 159-178 of Galactic and Extra-Galactic Radio Astronomy. Verschuur, G. L.; Kellermann, K. I. (eds.). New York; Springer-Verlag (1974).

Observational data on radio emission from stars is reviewed, and the history of the subject is given. The discussion covers the early years of the search for radio stars, the dawn of stellar radio astronomy, radio novae, radio binary stars, radio counterparts of x-ray stars, the radio counterpart of Cyg X-3, the future of radio astronomy, and related matters. (IAA)

Solar Phenomena

Refer also to abstracts 20500, 20507, 20544, 20568, 20722, 20746, 20762, 20775, 20777, and 21338.

20624 (AD-767746) FINE STRUCTURE OF THE SOLAR CHROMOSPHERE. Annual Report No. 3, 1 August 1971–31 January 1973. Bhavilai, R. (Applied Scientific Research Corp. of Thailand, Bangkok). Mar 1973. 18p. (ARDG(FE)-344-3). NTIS $2.75.

The design, construction and details of a 150 mm f/10 solar chromospheric telescope recently installed at the Department of Physics is described. The optical components, the Zeiss H-alpha Monochromator and the Acme cinecamera are placed on a 2.30 meter long spar mounted equatorially. Motion in hour angle is powered by a synchronous motor, while guiding is done through a set of differential gear driven by a servomotor responding to an error signal from the Zeiss Photoelectric Sun Guiding Tube. This also controls guiding in the declination axis. The telescope performs satisfactorily and is in continuous operation in the time-lapse cinematographic mode. The results of reduction of the data obtained in 1971 are presented. Isophotometric studies of the limb photographs confirm that bright mottles inside the limb corresponds to spicules just outside. On the disk, more evidences are obtained in contradiction to the idea that dark mottles are spicules. The bright streaks discovered by Bhavilai (1968) are confirmed. Apparent material motions in loops are found between dark mottles near the solar limb. (auth)

20625 (AD/A-001124) REPORT ON THE SOLAR PHYSICS–PLASMA PHYSICS WORKSHOP HELD AT STANFORD UNIVERSITY, SEPTEMBER 17–20, 1974. Baum, P. J.; Beckers, J. M.; Newman, C. E.; Priest, E. R.; Rosenberg, H. (Stanford Univ., Calif. (USA). Inst. for Plasma Research). Oct 1974. 35p. (CONF-740977–; SU-IPR-594). NTIS $3.75.

The proceedings of a meeting held on September 17–20, 1974, at Stanford University are summarized. The purpose was to explore plasma physics problems which arise in the study of solar physics. Sessions were concerned with specific questions including the following: is the solar plasma thermal or non-thermal. What spectroscopic data is required. What types of magnetic field structures exist. Do mhd instabilities occur. Do resistive or non-mhd instabilities occur. What mechanisms of particle acceleration have been proposed. What information do we have concerning shock waves. For each question, there was discussion concerning the observational evidence, theoretical analyses, and existing or potential laboratory and numerical experiments. (GRA)

20626 (AD/A-001175) SUN REVEALS ITS SECRETS. Borisov, O. Translated by C. T. Ostertag, Jr. From Zarya Vostoka; No. 118, 4(23 May 1974). 7p. (FTD-HT-23-0008-75). NTIS $3.25.

A brief description is given of solar phenomena observed from a solar observatory launched by the USSR. (GRA)

20627 (AD/A-003383) DETECTION AND CLASSIFICATION OF SOLAR X-RAY FLARES USING VLF PHASE AND AMPLITUDE INFORMATION. Kossey, P. A.; Lewis, E. A. (Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. (USA)). 20 Sep 1974. 40p. (AFCRL-ERP-486; AFCRL-TR-74-0468). NTIS $3.75.

An extensive data base consisting of vlf records for 130 different propagation paths over a 2-year period was analyzed statistically to study the correlation of vlf propagation changes with solar x-ray events recorded by satellites. Results of the study indicate that with reasonable restrictions on path illumination conditions, it is possible to detect and classify solar x-ray flares, in near realtime, by proper interpretation of vlf phase and amplitude variations. A method of calibrating vlf paths for this purpose is discussed, and a possible global network of receiving stations capable of 24-hr per day monitoring of solar x-rays is described. (GRA)

20628 (AD/A-003391) AREA AND SPACE INTEGRATED LIGHT DEFICIT OF SUNSPOT IMAGES. Final Report, 1 April 1973–30 June 1974. Trowbridge, C. A.; Miller, C. S. (Photometrics, Inc., Lexington, Mass. (USA)). 31 Jul 1974. 52p. (PHM-107-74; AFCRL-TR-74-0352). NTIS $4.25.

Microdensitometric film reduction, analysis and display techniques, and digital computer analysis and display were applied to solar surface radiance data. Photographs of sunspot activity were converted to isophote contour maps and digital optical density arrays recorded on magnetic tape. Edge discrimination and background-correction procedures were developed to semi-automatically determine sunspot area and integrated light deficit from these digital data. Sample results of the methods developed are given. (GRA)

20629 (COM-74-50190-361-1) SOLAR-GEOPHYSICAL DATA NUMBER 361, SEPTEMBER 1974. Part I (Prompt Reports). Data for August 1974, July 1974. Leighton, H. I. (National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo. (USA)). Sep 1974. 137p. (SGD-361-PT-1; NOAA-74101701). National Climatic Center, Asheville, NC 28801, $1.25.

Prompt reports are given on data for August 1974 and July 1974. These deal with alert periods, daily solar indices, solar flares, solar radio waves, spacecraft observations, solar proton monitoring, inferred IP magnetic field polarities, daily solar activity centers, sudden ionospheric disturbances, cosmic rays, geomagnetic indices and radio propagation indices. This issue also includes an index for 1973 and 1974. (GRA)

20630 (N-74-33252) SOLAR ^{3}He: INFORMATION FROM NUCLEAR REACTIONS IN FLARES. Ramaty, R.; Kozlovsky, B. (National Aeronautics and Space Administration, Greenbelt, Md. (USA), Goddard Space Flight Center). Aug 1974. 32p. (NASA-TM-X-70750; X-660-74-255). NTIS $4.75.

Information on solar ^{3}He from nuclear reactions in flares was considered. Consideration was also given to the development of models for these reactions as well as the abundance of ^{3}He in the photosphere. Data show that abundances may be explained by

nuclear reactions of flare acceleration protons and alpha particles with the ambient atmosphere, provided that various assumptions are made on the directionality of the interacting beams and acceleration of the particles after production. (auth)

20631 (N-74-34259) STRUCTURAL AND SPECTRAL STUDIES OF SUNSPOTS. Final Report, 1 Sep 1967–31 Aug 1974. Wyller, A. A. (Bartol Research Foundation, Swarthmore, Pa. (USA)). 9 Oct 1974. 76p. (NASA-CR-140395). NTIS $7.00.

Observations of umbral cores, both by multicolor photometry and by narrow band photometry in the vicinity of the sodium D lines, are described, and evidence is given which supports the validity of many umbral models, each of which describes different aspects of the observed umbral cores. Theoretical studies carried on at the observatory include the following: (1) Zeeman profiles of the sodium D sub 2 line and other lines; (2) turbulent heat conduction, sound waves, and the missing flux in sunspots; (3) chromospheric heating above spots by Alfven waves; (4) magnetic convection in the sun and solar neutrinos; (5) models of starspots on flare stars; (6) starspots on the primaries of contact binary systems; and (7) implications of starspots on red dwarfs. (STAR)

20632 (N-74-34270) DATA CATALOG OF SATELLITE EXPERIMENTS. Supplement 2C: Astronomy and Solar Physics. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). Oct 1974. 27p. (NASA-TM-X-72529). NTIS $4.50.

Each data set contained in this catalog lists spacecraft characteristics, experiment personnel, and a brief description of astronomy and solar physics experiments. (STAR)

20633 (N-74-35137) SOLAR PHYSICS. Plasma Physics Workshop. Baum, P. J.; Beckers, J. M.; Newman, C. E.; Priest, E. R.; Rosenberg, H.; Smith, D. F.; Sturrock, P. A.; Wentzel, D. G. (Stanford Univ., Calif. (USA). Inst. for Plasma Research). Oct 1974. 35p. (NASA-CR-140571; SU-IPR-594). NTIS $4.75.

A summary of the proceedings of a conference whose purpose was to explore plasma physics problems which arise in the study of solar physics is provided. Sessions were concerned with specific questions including the following: (1) whether the solar plasma is thermal or non-thermal; (2) what spectroscopic data is required; (3) what types of magnetic field structures exist; (4) whether magnetohydrodynamic instabilities occur; (5) whether resistive or non-magnetohydrodynamic instabilities occur; (6) what mechanisms of particle acceleration have been proposed; and (7) what information is available concerning shock waves. (STAR)

20634 (N-74-35215) OBSERVATIONS OF HYDROGEN AND HELIUM ISOTOPES IN SOLAR COSMIC RAYS. Hurford, G. J. (California Inst. of Tech., Pasadena (USA)). Oct 1974. Contract NAS5-11066. 135p. NTIS $9.75.

Thesis.

The isotopic composition of hydrogen and helium in solar cosmic rays provides a means of studying solar flare particle acceleration mechanisms since the enhanced relative abundance of rare isotopes, such as ^{2}H, ^{3}H, and ^{3}He, is due to their production by inelastic nuclear collisions in the solar atmosphere during the flare. Electron isotope spectrometer on an IMP spacecraft was used to measure this isotopic composition. The response of the dE/dx-E particle telescope is discussed, and alpha particle channeling in thin detectors is identified as an important background source affecting measurement of low values of ($^{3}He/^{4}He$). The flare-averaged results obtained for the period October, 1972–November, 1973 are given. (auth)

20635 (N-74-35216) MODEL OF CORONAL HOLES. Adams, W. M.; Sturrock, P. A. (Stanford Univ., Calif. (USA). Inst. for Plasma Research). Sep 1974. Contract N00014-67-A-0112-0062. 20p. (NASA-CR-140573; SU-IPR-592). NTIS $4.00.

It has been noted that coronal holes appear to be associated with regions of diverging magnetic field in the corona. It was undertaken to test the hypothesis that coronal holes may be caused by an increased flow of energy into the solar wind resulting directly from this diverging magnetic field pattern. Simple models were devised to approximate the energy flow down into the transition region and up into the solar wind as a function of the temperature, density, and rate of field line divergence in the corona. By assuming the rate of mechanical energy influx into the corona to be constant, it was then possible to solve numerically for the coronal temperature and density as a function of the rate of field line divergence. The results of these calculations demonstrate that a diverging field pattern can, indeed, bring about reductions in the temperature and density at the base of the corona comparable to those observed in coronal holes. (auth)

20636 (N-75-10892) COORDINATED ROCKET AND SATELLITE OBSERVATIONS OF THE SOLAR CORONA. Final Report. Zaumen, W. T. (Lockheed Missiles and Space Co., Palo Alto, Calif. (USA)). Jul 1974. Contract NASw-2589. 11p. (NASA-CR-140581; LMSC-D-404808). NTIS $3.25.

Coronal condensations associated with active regions are investigated by comparing their X-ray and EUV line intensities. The EUV line measurements were made with the OSO-H satellite, and the X-ray measurements were made with an ATM support rocket. The data obtained from these observations are used to find the emission measure distribution at low temperatures. (auth)

20637 (N-75-10893) TERMINATION OF THE SOLAR WIND IN THE HOT, PARTIALLY IONIZED INTERSTELLAR MEDIUM. Lombard, C. K. (Stanford Univ., Calif. (USA)). Nov 1974. 152p. (NASA-CR-140699). NTIS $6.25.

Thesis.

Theoretical foundations for understanding the problem of the termination of the solar wind are reexamined in the light of most recent findings concerning the states of the solar wind and the local interstellar medium. The investigation suggests that a simple extension of Parker's (1961) analytical model provides a useful approximate description of the combined solar wind, interstellar wind plasma flowfield under conditions presently thought to occur. A linear perturbation solution exhibiting both the effects of photoionization and charge exchange is obtained for the supersonic solar wind. A numerical algorithm is described for computing moments of the non-equilibrium hydrogen distribution function and associated source terms for the MHD equations. Computed using the algorithm in conjunction with the extended Parker solution to approximate the plasma flowfield, profiles of hydrogen number density are given in the solar wind along the upstream and downstream axes of flow with respect to the direction of the interstellar wind. Predictions of solar Lyman-alpha backscatter intensities to be observed at 1 a.u. have been computed, in turn, from a set of such hydrogen number density profiles varied over assumed conditions of the interstellar wind. (auth)

20638 (N-75-10899) VARIATION OF SOLAR PROTON ENERGY SPECTRA SIZE DISTRIBUTION WITH HELIOLONGITUDE. VanHollebeke, M. A. I.; MaSung, L. S.; McDonald, F. B. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). Sep 1974. 72p. (NASA-TM-X-70770; X-660-74-298). NTIS $4.25.

A statistical study of the initial phases of 185 solar particle events was carried out using the data from cosmic ray experiments on IMP 4 and IMP 5. Special emphasis was placed on the identification of the associated solar flare, as the parent flare can be determined for 68 percent of the events. It appears probable that most of the unidentified increases occur on the non-visible disc of the sun. The existence of a preferred-connection longitude between 20 W and 80 W was established by examining the heliolongitude of all the flare associated events. It is demonstrated that the energy spectra determined at the time of maximum particle in the 20 to 80 MeV or 4 to 20 MeV interval range give results identical to that obtained by the distance-travelled method. (auth)

20639 (PB-237810) ABSOLUTE RADIANT INTENSITY OF THE CENTER OF THE SOLAR DISC IN THE SPECTRAL RANGE $6389 \leq \lambda \leq 12480$ A. Labs, D.; Neckel, H. Translated from Z. Astrophys.; 57: 283-287(1963). 9p. NTIS $3.25.

Absolute intensities for the center of the solar disc are given in the spectral range from 6389 to 12480 A. The infrared intensities are measured only in those spectral regions which are practically free from atmospheric absorption bands. The results are given in a table. (GRA)

20640 OBSERVATIONS OF SOLAR RADIO EMISSION AT 146 MHz INSTRUMENTAL AND DATA ANALYSIS. Liu, H. C. (Peking Observatory); Ho, H. T. Tien Wen Hsueh Pao; 15: No. 1, 61-72(Apr 1974). (In Chinese).

The 16-dish E–W interferometer of the Mi-yun Station, Peking Observatory (working frequency 146 MHz) is described. Measured instrumental parameters are compared with theoretical ones. Thus the measured beam-width was 5'.4 (5'.3 theoretical), the first sidelobe level amounted to 5 percent (4.5 percent theoretical) and the locations of grating lobes in the celestial sphere were very close to the theoretical positions. These show that the surveying of baseline, the installation of antennas and the adjustment of transmission lines are reasonably accurate in our case. The observations of the quiet sun and the slowly varying component are described. In contrast to the results obtained by some authors, we found that the apparent diameter of the meter-wave sun had not varied during the descending phase of the solar cycle. The results of measurements of type-I sources are analyzed. According to the rate of occurrence of type-I bursts, the sources are classified into four classes. It is found that (1) the average height above photosphere of sources of all classes as measured at the central region of the solar disc was 0.24 $R_{\odot}$; (2) the E–W distribution of sources was asymmetric with respect to the solar meridian, in agreement with the result of Fokker; (3) the frequency distributions over the solar disc were

different for sources of different classes. The sources containing more type-I bursts decreased more rapidly than the continuum sources with respect to the height; (4) the correlation between the commencement of noise storms with the appearance of optical flares seemed to be rather weak. This differed from the result of Mallinge; and (5) the occurrence of noise storm sources was closely connected with the mean flare index of the plage region. For all plage regions associated with large sunspots and strong magnetic fields, the mean flare index had an average value of 14.33 among these regions for those also containing meterwave sources, this value rose up to 27.15 while for those which did not possess meter-wave sources, the average index was 7.32. (JPRS)

20641 OBSERVATION OF SOLAR RADIO EMISSION AT 146 MHz: INSTRUMENTAL AND DATA ANALYSIS. Liu, X. Z. (Peking Observatory); He, X. T. Tzu Tung Hua Hsueh Pao; 15: 61-72(Apr 1974). (In Chinese).

The 16-dish, 146-MHz, E–W interferometer at Peking Observatory is described, and observational data of the quiet sun and the slowly varying components are analyzed along with measurements of type-1 sources. It was found that the apparent diameter of the meter-wave sun had not varied during the descending phase of the solar cycle. According to the rate of occurrence of type-1 bursts, four classes of sources are discerned. The average height above photosphere of sources of all classes as measured at the central region of the solar disk was 0.24 solar radii. The E–W distribution of sources was asymmetric with respect to the solar meridian. The frequency distributions over the solar disk were different for sources of different classes: sources containing more type-1 bursts decreased more rapidly than the continuum sources with respect to height. Correlation between commencement of noise storms with appearance of optical flares seemed rather weak. The occurrence of noise storm sources was closely linked with the mean flare index of the plage region. (IAA)

20642 LABORATORY REPRODUCTION OF SOLAR X-RAY FLARE SPECTRUM. Gol'ts, E. Ya.; Zhitnik, I. A.; Kononov, E. Ya.; Mandel'shtam, S. L.; Sidel'nikov, Yu. V. (Inst. of Spectroscopy, Moscow). Dokl. Akad. Nauk SSSR; 220: No. 3, 560-563(21 Jan 1975). (In Russian).

A laboratory installation for the reproduction of solar x-ray flares was developed which uses as a source a high-voltage vacuum spark of the plasma point type. The spectrum obtained and the assignment of the lines to ions of Fe with different degrees of ionization are shown. This spectrum is compared with a solar x-ray spectrum obtained during the flare of Nov. 16, 1970. Both these values were compared with theoretical calculations. The agreement of all three values lies within the limits of experimental error. The variation of the intensities of the lines in the laboratory and solar spectra is discussed. (3 figures, 1 table) (JSR)

20643 HEAT FLUX IN CALM SOLAR WINDS. Fridman, M. (Univ., Liege). Bull. Soc. Roy. Sci. Liege; 43: No. 7-10, 459-472(1974). (In French).

The heat flux equations have been obtained when the flow is parallel to the magnetic field and the transverse symmetrisation in the velocity space is imposed. The results are verified in different ways: kinetical approach or moment method closed by a 6 moment Grad formalism and by series expansion equivalent to Hollweg (1970) development in the kinetical theory. The distribution function proposed by Whang (1971) to interpret the Hundhausen (1970) experimental data and the derived equations are used to estimate the heat flux. It is found to be of the same order as the experimental results. If this function is used at the origin of the system with typical parameters at 1 A. U. of the quiet solar wind, the heat flux difference between 55 and 210 solar radii is evaluated. This numerical agreement in order of magnitude validates the formalism which has been adopted. These results can also be used to estimate the discrepancies between the actual and calculated quiet solar winds. (auth)

20644 ANALYSIS OF BROAD-BAND OBSERVATIONS OF THE X-RAY RADIATION FROM A CORONAL CONDENSATION. Sylwester, J. A. (Inst. of Astronomy, Warsaw). Acta Astron.; 24: No. 3, 299-308(1974).

Analysis of the X-ray radiation from the central core of a coronal condensation was carried out on the basis of the condensation model of Landini and Monsignori Fossi. The maximum temperature and emission measure in this model were treated as variable parameters, and their values were estimated on the basis of observational data. Observations made from the rocket "Vertikal 1" were used in the analysis. Moreover, from the same observations, an estimation of the temperature and emission measure of the condensation core was made assuming an isothermal model for this region. A comparison of the results obtained in the two approaches shows significant differences between the non-isothermal and isothermal interpretation of the observations. (auth)

20645 ANALYSIS OF RESONANCE LINE FORMATION IN THE X-RAY SPECTRUM OF CORONAL CONDENSATIONS. Sylwester, B. M. (Inst. of Astronomy, Warsaw). Acta Astron.; 24: No. 3, 285-297(1974).

The values of the X-ray radiation fluxes in several resonance lines, which are formed in coronal condensations, have been calculated. The calculations were performed making use of the coronal condensation model worked out by Landini and Monsignori Fossi. A comparison of the obtained theoretical values of the fluxes with observational data was made in order to test the model. The analysis indicates that the coronal condensation model given by Landini and Monsignori Fossi does not describe the real structure of such a region adequately. (auth)

20646 MORPHOLOGICAL STUDY OF A SOLAR ACTIVE REGION IN AUGUST 1972. Tien Wen Hsueh Pao; 15: No. 1, 25-33(Apr 1974). (In Chinese).

Some photographs of the white-light fine structure of a large sunspot group in August 1972 have been successfully obtained at Yunnan Observatory. From a detailed study of the daily variations of the morphology of the sunspot group, the following conclusions can be drawn: 1. The dynamical morphology of sunspots associated with umbral rotational motion, i.e., the spiral structure of the arrangement of penumbral filaments, has been observed. 2. The rotation, proper motion and fission of the umbra in the middle portion of the large sunspot group in August 1972, and the lengthening, bending and degeneration of its east-west serpent-like long filaments are the main characteristic features of the photospheric morphological changes of this active region. These movements are intrinsic properties of the sunspot group under consideration, and are not directly related to differential rotation or other phenomena. 3. There is a good correlation between the excitation process of the morphological changes of sunspots in the photosphere and the degree of activity of flares in the chromosphere. This shows that these two processes may have some close physical connections. (JPRS)

20647 SOME CHARACTERISTICS OF SOLAR PROTON ACTIVITY DURING THE 20TH CYCLE. Tien Wen Hsueh Pao; 15: No. 1, 34-42(Apr 1974). (In Chinese).

Some characteristics of the solar proton events and proton-active regions during the period Oct. 1964 to Dec. 1972 of the 20th cycle are discussed. The frequency distribution of proton events with importance ≥ 1 in 1967-1970 is nearly uniform. In 1971 the proton activity is considerably decreased, but in 1972 it is increased again in coincidence with the sunspot activity. Most of the solar proton events, in particular, the proton events with greater importance, cluster in two preferred time intervals. The proton activity is clustered in certain heliographic longitudinal regions. The features of the activity of sunspot and radio-burst are different in different longitudinal regions. For example, in the 60°-90° region, the great majority of proton flares has occurred in large sunspot groups and are associated with cm-bursts. The magnetic configurations of sunspot groups are separated into two classes: normal, having the configurations of ordinary bipolar groups and abnormal, including δ-configuration, antipolarity, configuration with preceding spot at higher latitude and with the magnetic axis inclination greater than 30°. The sunspot groups with abnormal configurations have generated the great majority of the proton flares. The appearance of sources emitted at meter-wavelength over magnetically-complex active regions is favorable to the generation of proton flares. (JPRS)

20648 LINES FORMATION IN SLOWLY MOVING MEDIA. Grinin, V. P. Izv. Krym. Astrofiz. Observ.; 51: 65-73(1974). (In Russian).

A method is presented for calculation of the line profiles generated in a medium with differential motions. The method is based on an expansion of the intensity $I(\mu,x,\gamma)$ into a power series of velocity gradient γ (a small parameter). In this expansion the derivatives of $I_\gamma^{(\kappa)}(\mu,x)$ ($\kappa = 1, 2, 3$) are expressed using the easily found $\xi = \alpha(x)/\mu$ derivatives of "undisturbed" profile $I(\xi)$, corresponding to a medium without motions. The methods developed for this case and results of the asymptotic theory are applied for solution of many problems connected with the interpretation of line profiles in spectra of solar flares and moustaches. (auth)

20649 SUNSPOT MODEL. Baranovskii, E. A. Izv. Krym. Astrofiz. Observ.; 51: 56-59(1974). (In Russian).

A sunspot model is derived on the basis of the equivalent widths of the weak lines of Sc I, Zr I, V I, Ti I, Ni I, Fe I and profiles of the strong ones (D_2 Na I, K Ca II, H_α). The equivalent widths and the profiles are calculated according to the non-LTE theory of the formation of the lines. It is found that a non-LTE theory provides a much better agreement between theoretical and observed equivalent widths than it is possible to achieve with the calculations based on the LTE formulae. An increase of the electronic density up to $3 \cdot 10^{11}$ and a sudden decrease of the total

density (from 10^{15} to $3 \cdot 10^{11}$) is found in the chromosphere at the height of 1000-2000 km. There is also an abrupt increase of the temperature (up to 11000°) at this height. (auth)

20650 INVESTIGATION OF THE TRANSVERSAL MAGNETIC FIELD IN SUNSPOTS. Kotov, V. A. Izv. Krym. Astrofiz. Observ.; 39-55(1974). (In Russian).

From the magnetograph measurements made in spectral lines of different intensities, viz. λ4808 Fe I, λ5250 Fe I, λ6103 Ca I and H_α, the effect of depth rotation of the transversal magnetic field $H_\perp$ was considered. In accordance with findings of A. Severny a significant change (45°–90°) of the $H_\perp$-orientation is found in separate regions of spots. The greatest rotation has been observed inside umbrae, but it needs more detailed measurements to be reliable. The change of transversal field orientation is the most pronounced going from the deepest λ4808 line to the λ5250 and λ6103 lines, and further to the H_α line; the emergent radiation in the λ5250 line is apparently formed in the uppermost layers of spots. Observations of the $H_\perp$-field rotation in spots of the North and South polarities do not contradict the dependence of the sense of rotation upon the field polarity, which follows from the Zeeman-effect theory with the anomalous dispersion taken into account. (auth)

20651 COMPARISON OF THE H_α AND K Ca II RADIATION IN THE SOLAR FLARES. Tsap, T. T.; Kramynin, A. P. Izv. Krym. Astrofiz. Observ.; 51: 32-38(1974). (In Russian).

Relations between the brightness of the H_α and K Ca II lines in the solar flares are studied on the basis of the spectroheliograms, taken with the double spectroheliograph of the Crimean astrophysical observatory. It is found that there is a good accordance between the locations of the flare knots in the H_α and K Ca II lines. During the flare evolution the brightness oscillations in the H_α and K lines are synchronic. The K Ca II brightness from the flocculi to the flares increases faster than the H_α brightness. Evidently observational radiation features in the H_α and K Ca II lines of the flares can be connected with the collisional excitation. (auth)

20652 SOME CONDITIONS OF THE ORIGIN OF THE TWO-RIBBON CHROMOSPHERIC FLARES. Ogir, M. B. Izv. Krym. Astrofiz. Observ.; 51: 19-31(1974). (In Russian).

The structure peculiarities of the regions of two-ribbon flares were investigated. The chromospheric activity in the flare regions before flare appearance was studied by means of H_α-films. The configuration of magnetic fields in the same regions was studied by means of magnetic field maps. It was observed that in discussed cases two-ribbon flares originated in the accomplishing of such configuration of magnetic field when three (and sometimes four) rows of magnetic hills of different polarities adjoined to each other. That two rows of hills, between which the flare occurred, always were long enough—by order of 10^5 km. The width of the inner region, situated between the poles of opposite sign, is by order of 10^4 km. The arising of chromospheric activity before the flare origin was observed in one of the outer regions of magnetic field hills. (auth)

20653 DEPENDENCE BETWEEN FLARE ACTIVITY OF THE SUNSPOT GROUPS AND THE ORIENTATION OF THE LINE DIVIDING THE MAGNETIC FIELD POLARITIES. Koval, A. N. Izv. Krym. Astrofiz. Observ.; 51: 13-18(1974). (In Russian).

The visual measurements of the sunspot magnetic field and the flare data for 1968 were used. It is found that the orientation of the line dividing the magnetic field polarities relatively to the meridian can be used as one of the parameters which characterizes flare activity of the sunspot group. The presence of even the small part of zero line, which is perpendicular to the meridian, leads to an 80%-probability of the appearence of at least one flare of the importance ≥ 1. (auth)

20654 QUANTITATIVE MEASUREMENTS OF THE H_α AND K BRIGHTNESS OF THE PLAGES AS A CRITERIUM FOR FORECASTING OF ACTIVE REGION DEVELOPMENT. Stepanyan, N. N. Izv. Krym. Astrofiz. Observ.; 51: 8-12(1974). (In Russian).

It is shown that the measurements of H_α and K brightness for 80% plages allow to estimate its flare activity on 85% probability's level. Only 20% plages having definite ratio H_α and K brightness (region II in fig. 2) have equal the probabilities for presence and absence of the flares. The brightness of the plages in H_α and K-lines may be used as one of the quantitative criterium for forecasting of flare activity in short time (1–2 days) and middle time (¼ rotation of the Sun) scales. (auth)

20655 MAGNITUDE OF VARIATION OF SOLAR ACTIVITY IN DIFFERENT CYCLES. Mergentaler, J. Postepy Astron.; 23: No. 1, 65-68(1975). (In Polish).

Mean differences between the consecutive monthly averages of Wolf numbers were computed and compared with the mean errors computed for cycles VI–XIX by the author and by E. B. Balli. The peculiarity of the XIVth cycle is noted. (auth)

20656 RADIO OBSERVATIONS FROM INTERCOSMOS–KOPERNIK 500 SATELLITE. Hanasz, J.; Schreiber, R.; Welnowski, H.; Wikierski, B.; Aksenow, W. I. Postepy Astron.; 23: No. 1, 3-10(1975). (In Polish).

The space experiment Intercosmos–Kopernik 500 is briefly described. 50 solar type III radio bursts were observed with the aid of a radio-spectograph swept over the frequency range of 0.6 to 6.0 MHz. Irregular structure of some type III bursts was discovered during the increasing phase of bursts. It resembles decametric type IIIb bursts. Ionospheric plasma resonances were continuously recorded. (auth)

20657 SOLAR FLARE'S ACTIVITY DISTRIBUTION AROUND THE SECTOR-STRUCTURE BOUNDARIES EXTRAPOLATED TO THE SUN. Vladimirskii, B. M.; Levitskii, L. S. Izv. Krym. Astrofiz. Observ.; 51: 74-79(1974). (In Russian).

The interplanetary magnetic field sector boundaries data which were derived from geomagnetic field measurements in Polar Caps (years 1957–61) were used to study a distribution flare's activity around sector's boundaries extrapolated to the sun. The proton flare's activity on the solar surface is found to be concentrated to the boundaries. The PCA amplitudes as well as the amplitudes of the cm-wave radio bursts are highest near the sector's boundary. The activity level is more for leading parts of the sector. There is N–S asymmetry in the effect of the concentration. The concentration does not depend on flare's heliolatitude. These results are in good accordance with the results based on the interplanetary measurements of the sector's boundaries. (auth)

20658 COMMENTS ON THE TWO-RIBBON FLARE WITHOUT SUNSPOTS OF 29 JULY 1973. Hejna, L. (Astronomical Inst., Ondrejov, Czech.). Bull. Astron. Inst. Czech.; 26: No. 2, 119-126(1975).

The overall development of the active region of the two-ribbon flare without sunspots is studied. Common features between this type of flare and proton flares are sought. The conclusion is drawn that the spotless flares are a kind of "pure" type of the proton flare with a relatively simple structure, free of the "deformations" due to high intensity magnetic fields in sunspots. (auth)

20659 THE 35 GHz SOLAR INTERFEROMETER AT NAGOYA. Kawabata, K.; Ogawa, H.; Sofue, Y.; Suzuki, I. (Nagoya Univ. (Japan). Dept. of Physics). Publ. Astron. Soc. Jap.; 26: No. 3, 387-398(Sep 1974).

An eight antenna adding interferometer at 35 GHz (8.6 mm wavelengths) has been constructed at the Department of Physics, Nagoya University. Each antenna consists of a fixed paraboloidal reflector with a Cassegrain feed system and of a steerable plane reflector. The eight plane reflectors of equatorial mounting are aligned along an east-west line with an equal spacing. Each paraboloidal reflector is fixed pointing downwards in such a way that the axis of the paraboloidal reflector coincides with the polar axis of the equatorial of each plane reflector. This system of antennas eliminates the need for the waveguide rotary joints and is usable even on rainy days. The interferometer has a total span of 16.38 m (1913 λ). The angular resolution and the scanning time interval are 1.4′ and about 50 s respectively at the meridian transit of the sun. Observations of the sun are regularly performed about 10 hr each day in summer and about 7 hr in winter. We discuss the performance of the interferometer in some detail and illustrate examples of observations. (auth)

20660 CORONAL MAGNETIC FIELDS INFERRED FROM SOURCE DISTRIBUTION OF CORRELATED BURSTS AND CONCURRENT TYPE I STORM. Kai, K.; Nakajima, H. (Tokyo Univ., Mitaka (Japan). Tokyo Astronomical Observatory). Publ. Astron. Soc. Jap.; 26: No. 3, 379-386(Sep 1974).

Numerous transient bursts (mostly type III) concurrent with a long-lived type I noise storm were observed from 4 to 12, March 1972 with the Nobeyama 160 MHz interferometer. The transient bursts occurred in many cases almost simultaneously or successively with a few seconds delay in separate sources with opposite polarity. These correlated bursts suggest that the separate sources must be linked by weak magnetic fields surrounding strong magnetic fields (presumably associated with the concurrent type I storm) with a common source of fast particles in a region lower than the 160 MHz plasma level. Possible configurations of magnetic fields above the associated active region are investigated on the basis of radio observation. (auth)

20661 OBSERVATION OF THE ABSOLUTE INTENSITY OF THE SUN IN THE VACUUM ULTRAVIOLET REGION. Nishi, K.; Higashi, K.; Yamaguchi, A. (Tokyo Univ., Mitaka (Japan). Tokyo Astronomical Observatory); Suemoto, Z. Tokyo Daigaku Uchu Koku Kenkyusho Hokoku; 10: No. 3, Pt.B, 611-620(Sep 1974). (In Japanese).

The absolute intensity of the solar spectrum between 1550Å and 1950Å was measured photoelectrically by the K-10-9 rocket

flown from the Kagoshima Space Center on Feb. 19, 1973. A single dispersive spectrometer with uniaxial sunfollower was used for the experiment to measure the radiation from the whole solar disk with a 78Å spectral resolution. The results were consistent with our earlier observation by the K-10-6 rocket and also by the Harvard College Observatory. (auth)

20662 GENERATION OF INTERMEDIATE DRIFT BURSTS IN SOLAR TYPE IV RADIO CONTINUA THROUGH COUPLING OF WHISTLER SOLITONS AND LANGMUIR WAVES. Kuijpers, J. (Rijksuniversiteit, Utrecht). pp 49-70 of Collective Wave-Particle Interactions in Solar Type IV Radio Sources. Kuijpers, J. (ed.). Utrecht; Rijksuniversiteit (14 Apr 1975).

The possible generation of intermediate drift bursts in type IV dm continua through coupling between whistler waves traveling along the magnetic field, and Langmuir waves excited by a loss-cone instability in the source region is elaborated. The generation, propagation and coupling of whistlers is investigated. It is shown that the superposition of an isotropic background plasma of 10^6 K and a loss-cone distribution of fast electrons is unstable for whistler waves if the loss-cone aperture 2α is sufficiently large. The whistlers can travel upwards through the source region of the continuum in the form of solitons with a velocity of $21.5\ v_A$(v_A is the Alfvén velocity). Coupling of the whistlers with Langmuir waves into escaping electromagnetic waves can lead to the observed intermediate drift bursts. In our model, the instantaneous bandwidth of the fibers corresponds to a frequency of $0.1-0.4\omega_{ce}$ and leads to estimates of the magnetic field strength in the source region. These estimates are in good agreement with those derived from the observed drift rate, corresponding to $21.5v_A$, if a simple hydrostatic density model is used. (NL)

20663 HIGH TIME RESOLUTION ANALYSIS OF SOLAR FLARES OBSERVED ON THE ESRO TD-14 SATELLITE. Hoyng, P.; Brown, J. C.; van Beek, H. F. (Rijksuniversiteit, Utrecht). pp 14-78 of Studies on Hard X-Ray Emission From Solar Flares and on Cyclotron Radiation From a Cold Magnetoplasma. Hoyng, P. (ed.). Utrecht; Rijksuniversiteit (23 Jun 1975).

The Utrecht hard solar X-ray spectrometer S-100 on board the ESRO TD-1A satellite covers the energy range above 25 keV in 12 logarithmically spaced energy channels. Observations of a number of solar flares in the period 12/03/72 - 01/10/73 are presented, among which are four flares from the highly active 1-8 August 1972 period. Spectral parameters for these flares are presented and analyzed. The suggestion is made that the hard X-ray observations admit a classification in two groups; the interpretation of observed breaks in the X-ray photon spectra is discussed. A time series analysis of the hard X-ray time profiles has been made including noise properties, the question of a correct definition of time scales involved in the hard X-ray emission and a discussion of their meaning and application, existence of periodicities, timing differences between short "spikes" at different energies. Correlations between various (derived) hard X-ray emission parameters have been looked for. A remarkable new feature is the good correlation between the thick target parameter of the large August 4, 1972 event. Finally, a few implications from the observations for existing (X-ray) flare models are discussed. Also the existence of streams of fast electrons is discussed; at these streams are very strong, they have important consequences for flare theory. (NL)

20664 INTERPRETATION OF HARD X-RAY AND MICROWAVE EMISSION OF THE FLARE OF MAY 18, 1972, UT 1406. Hoyng, P.; Stevens, G. A. (Rijksuniversiteit, Utrecht). pp 79-85 of Studies on Hard X-Ray Emission From Solar Flares and on Cyclotron Radiation From a Cold Magnetoplasma. Hoyng, P. (ed.). Utrecht; Rijksuniversiteit (23 Jun 1975).

From 1st European Astronomical meeting; Athens, Greece (1972).

An analysis of the flare of May 18, 1972, UT 1406, observed with the Utrecht hard solar X-ray spectrometer on board the ESRO satellite TD-1A is presented. Included in this analysis is the pertinent GHz radio data of this event. The proton density in the source region is inferred to be at least 5.10^8 cm^{-3}. The radio spectra are found to agree with calculations of Holt and Ramaty. The radio and X-ray data together result in a consistent set of parameters. (NL)

20665 BETATRON ACCELERATION IN THE LARGE SOLAR FLARE OF AUGUST 4, 1972. Brown, J. C.; Hoyng, P. (Rijksuniversiteit, Utrecht). pp 86-108 of Studies on Hard X-Ray Emission From Solar Flares and on Cyclotron Radiation From a Cold Magnetoplasma. Hoyng, P. (ed.). Utrecht; Rijksuniversiteit (23 Jun 1975).

The problem of diagnosing flare particle acceleration mechanisms from hard X-ray bursts is discussed and it is argued that the electron trap model of bursts is more amenable to observational investigation at present than models of thick-target type. It is then shown that data for the large X-ray burst of August 4, 1972 are consistent with the source electrons being trapped in a very large vibrating coronal magnetic bottle. Furthermore, the observations show that the burst time profile is not dominated by collisional losses. It is proposed instead that the entire profile is essentially determined by betatron action of the varying trap field on the electrons. This betatron model is then analyzed in detail and shown to predict very well the observed correlation of electron flux and spectral index in this event when it is supposed that the electrons are initially produced by a brief unspecified acceleration. Comparison of the model with observations permits inference of the approximate form of magnetic field evolution in the trap. (NL)

20666 PHYSICAL CONDITIONS OF ELECTRON ACCELERATION IN SOLAR FLARES. Hoyng, P. (Rijksuniversiteit, Utrecht). pp 109-122 of Studies on Hard X-Ray Emission From Solar Flares and On Cyclotron Radiation From a Cold Magnetoplasma. Hoyng, P. (ed.). Utrecht; Rijksuniversiteit (23 Jun 1975).

On the basis of observational facts, a discussion is given on what physical conditions might prevail in the electron acceleration region of ordinary solar flares. It is argued that electrons are probably accelerated by resonant interactions with electron plasma waves (Langmuir waves), and the possibilities of generating these from current sheets are discussed. Because the sheet volume itself is orders of magnitude too small to contain the observed number of fast electrons, their acceleration must take place outside the sheet. It is argued that nonlinear interactions are negligible and as a consequence, efficient electron acceleration can occur. (NL)

20667 POSSIBLE GENERATING MECHANISM FOR INTERMEDIATE DRIFT BURSTS. Kuijpers, J. (Rijksuniversiteit, Utrecht). pp 46-48 of Collective Wave-Particle Interactions in Solar Type IV Radio Sources. Kuijpers, J. (ed.). Utrecht; Rijksuniversiteit (14 Apr 1975).

From 3rd meeting committee European Solar Radio Astronomy; Floirac, France (1973).

20668 UNIFIED EXPLANATION OF SOLAR TYPE IV dm CONTINUA AND ZEBRA PATTERNS. Kuijpers, J. (Rijksuniversiteit, Utrecht). pp 35-45 of Collective Wave-Particle Interactions in Solar Type IV Radio Sources. Kuijpers, J. (ed.). Utrecht; Rijksuniversiteit (14 Apr 1975).

Both type IV dm continuum radiation and zebra patterns can have their origin in plasma waves at the upper hybrid frequency which are excited by a loss-cone distribution of fast electrons superposed on the thermal background. If the inverse fractional density of fast electrons surpasses the ratio of the electron plasma frequency to the electron cyclotron frequency, instability only exists at those places in the corona where this ratio is an integer thus giving rise to zebra patterns. Some observations in favor of the present explanation are discussed. Upper limits to the magnetic field strength and the fast particle density in the source are derived from the observations. (NL)

20669 SUNSPOT CYCLE INFLUENCE ON LUNAR AND SOLAR DAILY GEOMAGNETIC VARIATIONS. Malin, S. R. C.; Cecere, A.; Palumbo, A. (Inst. of Geological Sciences, Hailsham, Eng.). Geophys. J. R. Astron. Soc.; 41: No. 1, 115-126(Apr 1975).

The long standing question of whether L and S respond similarly to the sunspot cycle is re-examined using a very much more extensive data set than hitherto. The global distribution of the phenomenon is discussed in terms of the coefficients of simple spherical harmonic models, including the first such representation of the changes in S and L from sunspot minimum to maximum. Particular attention is paid to the confidence limits of the results, which indicate that many previously obscure points may be resolved with the present data set. In particular, it is shown that there are significant differences between the response of L and S to sunspot number and that the external currents associated with L do not flow mainly in the E-region as hitherto supposed. It is also shown that the original arguments in favour of the E-region as the location of the external S currents are no longer valid. (auth)

20670 COMPARISON OF SUNSPOT PERIODS WITH PLANETARY SYNODIC PERIOD RESONANCES. Wood, R. M. (McDouglas Astronautics Co., Huntington Beach, CA). Nature (London).; 255: No. 5506, 312-313(22 May 1975).

The possibility that the planets may have a causal effect on triggering solar activity is discussed. In order to determine the possible influence of several planets simultaneously on the Sun it was found convenient to consider them two at a time making use of their synodic periods (periods between successive conjunctions). A more general model than just the tidal concept is presented, since it is considered that tides are likely to be less

important than torque effects on the oblate spinning Sun. The study indicates a good correlation between planetary synodic period resonances and solar activity periods; it also indicates a rough correlation between the variations of the resonance period resulting from orbit eccentricity and variations of the sunspot period. (UK)

20671 LEVEL OF SOLAR X-RAY ACTIVITY AND ITS RELATION TO THE OCCURRENCE OF SUDDEN IONOSPHERIC DISTURBANCES. Deshpande, S. D. (College of Engineering, Aurangabad, India). Indian J. Radio Space Phys.; 3: No. 4, 337-340(Dec 1974).

Solar X-ray flares and associated sudden ionospheric disturbances (SIDs) are examined with respect to the level of solar 1-8 Å activity. A period of increasing solar activity from January 1966 to December 1969 has been considered. It is found that the occurrence of SIDs depends on the level of 1-8 Å activity and on the way in which it builds up. The threshold 1-8 Å flux for an X-ray flare to produce an SID effect increases with the level of solar activity. Peak 1-8 Å flux during X-ray flares increases with the level of solar activity and in the case of flares producing SIDs it is on the average 4-5 times larger than for flares without associated SIDs. 3 figs, 2 tables (auth)

20672 FLARE OF AUGUST 7, 1972. Albernhe, F.; Vedrenne, G.; Cambou, F.; Kuvdryuvtsev, M. I.; Likin, O. B.; Melioranskii, A. S.; Nazarova, N. I.; Pankov, V. M.; Pisarenko, N. F.; Savenko, I. A.; Talon, R.; Shamolin, V. M. Cosmic Res.; 12: No. 6, 842-846(1974).

Translated from Kosm. Issled.; 12: No. 6, 930-935(1974).

Instruments for the study of x-ray and gamma radiation of the sun and charged particle detectors mounted on the Prognoz-2 satellite recorded a burst of electromagnetic radiation and the arrival of high-energy protons connected with a flare of importance 3B which began at 15:00 UT in McMath region 11976 N 16, W 35. The results obtained and the general pattern of the flare event are discussed. 1 fig, 15 refs (auth)

20673 FORECASTING SOLAR COSMIC-RAY SPECTRA FROM INSTANTANEOUS MEASUREMENTS DATA. Miroshnichenko, L. I.; Nesterov, V. M.; Petrov, V. M.; Tibanov, A. P. Cosmic Res.; 12: No. 6, 808-814(1974).

Translated from Kosm. Issled.; 12: No. 6, 892-898(1974).

Heliophysical techniques of forecasting solar bursts are not helpful at present in estimating flux intensity or the index of the spectrum of cosmic radiation of solar origin as observed in the neighborhood of the earth. The present authors investigated the possibility of forecasting the behavior of these parameters on the basis of measurements taken of the differential intensities of solar cosmic radiation in the first moments following a solar burst. The nature of the time dependence of the integrated solar cosmic radiation flux confirms the validity of this approach to forecasting the spectra. The diffusion model accounting for propagation of particles, using the method of linearization and optimization of the parameter β in the expression for the diffusion coefficient, was utilized in the forecasting work discussed in this paper. Analysis shows that the method of optimizing the parameter β when forecasting solar cosmic radiation spectra makes it possible to deal appropriately with the position of the burst on the sun. 2 figs, 18 refs (auth)

20674 ELECTRON CONTENT POWER SPECTRAL ESTIMATES: PERIODS OF 2 DAYS TO HALF YEAR. Low, N. C.; Roelofs, T. H.; Yuen, P. C. (Univ. of Hawaii, Honolulu). Planet. Space Sci.; 23: No. 1, 133-141(Jan 1975).

The power spectra of the daily peak electron content measured at Hawaii are estimated via covariance estimations, bivariate autoregressive estimations and fast Fourier transforms for a year of data close to minimum solar activity (1965) and a year of data close to maximum solar activity (1969). The strong peaks about 6 days and 15 days in the 1965 and 1969 power spectra, respectively, suggest an influence of the interplanetary magnetic sector structure on the electron content at low latitude (21.3°N geographic). The daily solar flux (Sa) at 2800 MHz of 1965 and 1969 are analysed similarly. The decrease in energy content with period range of 3 to 7 days in the 1969 Sa power spectrum supports the above point of view. (auth)

Galaxies

Refer also to abstracts 20490, 20568, 20595, 20620, 20622, 20623, and 20721.

20675 X-RAY EMISSION FROM COMPACT GALACTIC NUCLEI. Occhionero, F. (CNR, Frascati, Italy). Soc. Astron. Ital., Mem.; 44: S271-S285(1974). (In Italian).

Review of a compact model proposed by Shklovskii (1966) which explains some of the X-ray emissions from extragalactic objects. According to this model, noticeable fluxes of hard radiation (both X-ray and gamma) can be produced as a result of the inverse Compton effect acting on the infrared radiation which the investigated galactic nuclei emit in large quantity. This latter radiation is assumed to be synchrotron radiation which is self-absorbed within the source. Certain formulas which make it possible to simultaneously treat both the process of synchrotron radiation and the inverse Compton effect and to define the basic relations between the various parameters of Shklovskii's model are reviewed. On the basis of a study of certain models constructed for typical values of the infrared and X-ray luminosity, it is concluded that Shklovskii's compact model for extragalactic X-ray sources is highly plausible from a conceptual standpoint. (IAA)

20676 EVIDENCE CONCERNING NUCLEAR EXPLOSION PHENOMENA OBTAINED FROM STELLAR POPULATIONS. Castellani, V. (Univ., Rome). Soc. Astron. Ital., Mem.; 44: S301-S316(1974). (In Italian).

Consideration of the possibility of the evolution of galactic populations through nuclear explosion phenomena. On the basis of an analysis of globular clusters, compact open clusters, and high-velocity stars, it is suggested that the populations of clusters may have originated from material ejected from the galactic nucleus. (IAA)

20677 SPECTRAL INVESTIGATION OF THE IRREGULAR GALAXY NGC 520. Khachikyan, E. E. Astrophysics.; 9: No. 2, 87-98(1973).

Translated from Astrofizika; 9: No. 2, 157-176(1973).

Results are given of a spectroscopic study of the irregular galaxy NGC 520 using Bowen's Cassegrain image-tube spectrograph of the 200-inch telescope of the Hale Observatories. In the spectrum of the northern part of the galaxy, the emission lines [OIII] λλ 5007 and 4959, Hβ, and [OII] λ 3727 were observed. In the spectrum of the southern part of the galaxy, the only emission line observed was λ 3727. In both parts of the galaxy, an absorption spectrum of early type is observed in addition to these emission lines. It is concluded that either population I stars play an important role in galaxies of the type M 82 or that NGC 520 is not a galaxy of the M 82 type. The line Hβ in the spectrum of the superassociation consists of two components: emission and absorption, the emission component being shifted to longer wavelengths relative to the absorption component by an amount corresponding to a velocity of 200–250 km/sec. It is shown that the gas components of the northern and southern parts of the galaxy are moving apart at approximately 400 km/sec. It is concluded that this outward movement of the gas is due, as in M 82, to an explosive process that occurred in the central region of NGC 520. (auth)

20678 GALACTIC NUCLEI. Gratton, L. (CNR, Frascati, Italy). Soc. Astron. Ital., Mem.; 44: S221-S250(1974). (In Italian).

Review of various types of radio sources that have been observed in galaxies and may be regarded as galactic nuclei is presented. A distinction is made between the concept of a galactic nucleus and the central region of a gelaxy as observed in almost all spiral galaxies and in most elliptic galaxies. A small nonthermal radio source, called Sagittarius A, is described which is situated exactly in the center of our Galaxy. The existence of such nuclei in other galaxies is then discussed, with particular reference to Seyfert galaxies, which form a particular class of spiral galaxies. Finally, the special features of a number of intense radio galaxies and quasi-stellar radio sources (quasars) are indicated. (IAA)

20679 THEORETICAL ASPECTS OF THE GAMMA EMISSION OF GALACTIC NUCLEI. Bonometto, S. (Univ., Padua). Soc. Astron. Ital., Mem.; 44: S287-S299(1974). (In Italian).

Consideration of the possibility of gamma emission from galactic sources as a result of the decay of neutral pions. The theory of the decay of neutral pions produced in collisions between cosmic rays and hydrogen and helium atoms is reviewed, and it is shown why the most recent data of Browning et al. (1972) do not agree with this theory. In addition, the problems which arise as a result of this lack of agreement are indicated. (IAA)

20680 OBSERVATIONS OF RADIO EMISSION OF CLUSTERS OF GALAXIES. Tovmasyan, G. M. Astrophysics.; 9: No. 2, 99-103(1973).

Translated from Astrofizika; 9: No. 2, 177-184(1973).

Radio emission at 1400 MHz with flux density in excess of 0.1 flux units was detected at the positions of 30 out of 111 observed clusters of galaxies. Observations were made with the 300-ft radio telescope of the National Radio Astronomy Observatory. (auth)

20681 RELATION BETWEEN PHENOMENA DUE TO THE GAS AND DUST COMPONENTS OF THE INTERSTELLAR MEDIUM. Gerashchenko, A. N. (Principal Astronomical Observatory, USSR). Astrophysics.; 9: No. 2, 170-172(1973).

Translated from Astrofizika; 9: No. 2, 301-306(1973).

The relations between the equivalent widths W of interstellar lines (K Ca II and D Na I) and the corresponding color excesses E were obtained from literature data for more than 500 stars. It is shown that only stars earlier than B8 can be represented by a homogeneous series. These are divided into two groups depending on the galactic latitude: I for $|\sin 2l| > 0.3$ and II for $|\sin 2l| < 0.3$. In group I the correlation is stronger (correlation ratio 0.7–0.8). The observations correspond to Spitzer's conclusion that the gas and dust clouds have the same direction. The scatter of the points in the W–E diagrams is due to the combined influence of line saturation, dispersion of the cloud velocities, and galactic rotation. For small color excesses, the continuously distributed gas medium has an important influence on the scatter. (auth)

20682 SPECTRA OF MARKARIAN GALAXIES. VII. Arakelyan, M. A.; Dibai, E. A.; Esipov, V. F. Astrophysics.; 9: No. 2, 180-181(1973).

Translated from Astrofizika; 9: No. 2, 319-321(1973).

The results of spectroscopic observations of sixteen Markaryan galaxies are presented. Emission lines were detected in the spectra of 11 objects. The objects Nos. 478, 486, and 506 have the spectral features of the nuclei of Seyfert galaxies. The galaxy Markaryan 507 also exhibits less prominent Seyfert features. (auth)

20683 NORMAL REDSHIFTS IN MARKARYAN GALAXIES AND REPLY BY TEERIKORPI, P. Huchra, J. (Hale Observatories, Pasadena, CA). Nature (London).; 255: No. 5507, 430 (29 May 1975).

Reference is made to Teerikorpi (Nature 252 : 110-11 (1974)) who claimed to have found evidence for anomalous red shifts in Markaryan galaxies. Some calculation errors are pointed out, and Huchra finds nothing in Teerikorpi's arguments to support his claim for anomalous red shifts or non-cosmological components for Markaryan galaxies. A reply by Teerikorpi is appended. (UK)

20684 ORIGIN OF BROAD INTERSTELLAR FEATURE AT 1.6 μm^{-1}. Manning, P. G. (University Coll. of Wales, Aberystwyth, Eng.). Nature (London).; 225: No. 5503, 40-41(1 May 1975).

It is suggested that a discontinuity at ~1.6 μm^{-1} seen on the mean extinction curve for several reddened stars represents $Fe^{2+} \rightarrow Fe^{3+}$ charge transfer absorption in interstellar grains. The estimated absorption of the 1.6 μm^{-1} feature is 0.1 mag kpc^{-1}, corresponding to a 0.03 μm thickness of magnetite along the line of sight. For a 1 cm^2 cross section of Fe_3O_4 over 1 kpc the average density of Fe_3O_4 in the interstellar medium is therefore 1.6×10^{-26} g/cm^3, and the Fe density is 1.2×10^{-26} g/cm^3, which is close to the accepted value of 0.7×10^{-26} g/cm^3. This shows that an oxide such as Fe_3O_4, with ferrous and ferric ions in adjacent edge-sharing octahedra, could be a component of interstellar dust. (UK)

20685 ASTROPHYSICS OF GASEOUS NEBULAE. Osterbrock, D. E. San Francisco; W. H. Freeman and Company (1974). 263p. $17.00.

Questions concerning the photoionization equilibrium are explored, taking into account hydrogen, helium, and heavy elements. The characteristics of thermal equilibrium are considered along with a calculation of the emitted spectrum, a comparison of theoretical studies with observational data, the internal dynamics of gaseous nebulae, and the H II regions in the galactic context. Aspects regarding the interstellar dust are investigated, giving attention to interstellar extinction, dust within H II regions, infrared emission, the survival of dust particles in an ionized nebula, and the dynamical effects of dust in nebulae. Other subjects discussed include the space distribution and kinematics of planetary nebulae, the origin of planetary nebulae and the evolution of their central stars, questions of mass return from planetary nebulae, and planetary nebulae in other galaxies. (IAA)

20686 COLLISIONS AND RELAXATION IN GALAXY CLUSTERS. Noerdlinger, P. D. (Michigan State Univ., Ann Arbor). Publ. Astron. Soc. Pac.; 87: No. 516, 333-334(Apr 1975).

The rate of close collisions among galaxies in a cluster, and the rates of both gravitational two-body and violent relaxation are shown, in most cases, to be proportional to the Hubble constant. Therefore, the number of collisions or the degree of relaxation attained in one Hubble time are invariant to the Hubble constant. (auth)

20687 EFFECT OF A VARIABLE MASS-LUMINOSITY RATIO ON THE COSMIC DENSITY. Noonan, T. W. (Brockport State Coll., NY). Publ. Astron. Soc. Pac.; 87: No. 516, 335-336(Apr 1975).

The effect on the cosmic density of the possibility that galaxian mass varies as a power of luminosity is examined. The smaller the exponent, the greater the mean density. It is possible to close the universe if the brighter galaxies have a mass-luminosity ratio of 250 (Hubble constant 100 km sec^{-1} Mpc^{-1}) and mass varies as the one-fourth power of luminosity. (auth)

20688 UBV PHOTOMETRY OF NGC 6649. Talbert, F. D. (San Diego State Univ., CA). Publ. Astron. Soc. Pac.; 87: No. 516, 341-344(Apr 1975).

This paper reports UBV photographic photometry of NGC 6649 and the analysis to derive a minimum distance modulus, $(m-M)_0$, of 11m4 which indicates the cluster is well within the Carina-Sagittarius-Scutum arm of the Milky Way. Distance and age of the cepheid V367 Sct near the cluster center are consistent with cluster membership. (auth)

20689 RATIO OF TOTAL-TO-SELECTIVE ABSORPTION. Olson, B. I. (Univ. of British Columbia, Vancouver). Publ. Astron. Soc. Pac.; 87: No. 516, 349-351(Apr 1975).

The variation of the ratio of total-to-selective absorption as a function of a star's intrinsic color and color excess has been examined. A relation is found that allows this variation to be expressed numerically. (auth)

20690 RADIO SPURS AND SPIRAL STRUCTURE OF THE GALAXY. II. On the Supernova Remnant Hypothesis for Spurs. Sofue, Y.; Hamajima, K.; Fujimoto, M. (Nagoya Univ. (Japan). Dept. of Physics). Publ. Astron. Soc. Jap.; 26: No. 3, 399-416 (Sep 1974).

A hypothesis that galactic spurs are due to nonthermal emission from supernova shells is shown to meet with some difficulties in the attempt to understand observational data on radio continuum distribution, starlight polarization, X-rays, Hα-emission, λ21-cm line emission, and interstellar dark matter in the spur regions. A galactic shock hypothesis, that the spur is a result of tangential view to diffuse nonthermal source extending just above and along the spiral shocked region of the Galaxy, is more compatible with these observations. (auth)

20691 INTERSTELLAR DEPLETION: A MYSTERY. de Boer, K. S. (Rijksuniversiteit, Groningen, Netherlands). pp 83-91 of Interstellar Absorption Lines in the Ultraviolet. de Boer, K. S. (ed.). Groningen; Rijksuniversiteit (20 Dec 1974).

Current theories on interstellar abundances are reviewed and it is concluded that part of the depletion of metals has to be explained by the lack of reliability of, and by errors in the curve of the growth method used in this analysis. The remaining depletion can be explained without much difficulty by assuming that the depleted metals are in the interstellar dust. (NL)

20692 RADIO HALO OF THE GALAXY. Webster, A. (Mullard Radio Astronomy Observatory, Cambridge). Mon. Not. R. Astron. Soc.; 171: No. 2, 243-257(May 1975).

A new way of analysing radio observations for evidence of a radio halo around the Galaxy is presented. When applied to appropriate measurements clear evidence for a weak radio halo with a steep spectrum is found. This radio halo is much weaker than expected on the hypothesis that the galactic cosmic rays fill the halo region. (auth)

20693 STUDY OF 3000 FAINT GALAXIES. Dodd, R. J.; Morgan, D. H.; Nandy, K.; Reddish, V. C.; Seddon, H. (Royal Observatory, Edinburgh). Mon. Not. R. Astron. Soc.; 171: No. 2, 329-351(May 1975).

Positions, sizes, shapes and orientations of images of 3000 faint galaxies in an area of 2 deg^2 near the south galactic pole have been measured on a photograph reaching B = 23 taken by the UK 48-in. Schmidt telescope in Australia. It is estimated that the galaxies observed are distributed to distances corresponding to redshifts of about 0.5. Comparison of the distribution of the apparently larger galaxies with the smaller ones shows that blank areas in the former are not repeated in the latter and consequently are not due to intergalactic obscuration. Twenty per cent of distant galaxies appear to be in groups of four or more, but there are no major clusters containing tens of galaxies or more. There is a significant degree of alignment of the major axes of adjacent images showing that a substantial fraction of all galaxies are in dynamically related pairs. There is no significant difference between the frequency distributions of ellipticities of the nearer and more distant galaxies but only major differences would have been detected. The number-diameter count shows: a local excess of sources within ~150 Mpc; a general agreement with conventional theoretical cosmological models; and a deviation from the theoretical models for small images. (auth)

20694 PHYSICAL CONDITIONS IN ACTIVE NUCLEI. Netzer, H. (Royal Greenwich Observatory, Hailsham, Eng.). Mon. Not. R. Astron. Soc.; 171: No. 2, 395-405(May 1975).

The Balmer decrement in Seyfert galaxies and QSO's is calculated under self-absorption conditions, using a "mean escape probability" technique. It is found that for densities of over $10^9 cm^{-3}$ and large optical depth in Hα, absorption from level 3

becomes significant. In such a case a large deviation from previous self-absorption calculations by Capriotti is obtained, and a steep decrement is common in most cases. Results for different optical depths in Ly α and different electron densities are given. Comparison with observational results is made, and a possible photoionization model introduced. (auth)

20695 ANALYSING PROCEDURES. de Boer, K. S. (Rijksuniversiteit, Groningen, Netherlands). pp 57-82 of Interstellar Absorption Lines in the Ultraviolet. de Boer, K. S. (ed.). Groningen; Rijksuniversiteit (20 Dec 1974).

The problems and uncertainties which arise when only the equivalent widths of observed lines are used for an analysis with the curve of growth are discussed. Gross errors have arisen from this method, in the older literature where the complexity of interstellar profiles could not yet be appreciated, but also the recent literature contains several erroneous results. The profiles available in o Per and ζ Oph are analysed based on a few simple restrictions as an example. The observed interstellar profiles in the visual range can be reconstructed quite well, and then other interstellar lines and profiles are more easily approached. (NL)

20696 ON THE POSSIBILITY OF RADIOASTRONOMICAL INVESTIGATION OF THE BIRTH OF GALAXIES. Sunyaev, R. A. (Inst. Fiziki, Moscow); Zel'dovich, Y. B. Mon. Not. R. Astron. Soc.; 171: No. 2, 375-379(May 1975).

During the prestellar epoch, protogalaxies were composed mainly of neutral hydrogen with mass approximately 100 times the mass of interstellar gas in galaxies today. Protogalaxies and protoclusters of galaxies therefore radiated strongly in the 21-cm line of neutral hydrogen. Due to cosmological redshift this line will be shifted to the metre wavelength band, so detection of redshifted 21-cm lines from protogalaxies may provide the possibility of finding the epoch of galaxy formation and the properties of protogalaxies. (auth)

20697 GALACTIC NONTHERMAL CONTINUUM EMISSION. Brown, R. L. (National Radio Astronomy Observatory, Green Bank, WV). pp 1-26 of Galactic and Extra-Galactic Radio Astronomy. Verschuur, G. L.; Kellermann, K. I. (eds.). New York; Springer-Verlag (1974).

The origins and properties of the galactic radio continuum are discussed. Such problems as the contribution of discrete sources, the presence of thermal radiation, low-frequency attenuation of the radio background, the existence of extended regions, and the isotropy or anisotropy of the distribution of emission about the galaxy are considered. Individual headings are the physical mechanisms, including synchrotron radiation and collective processes, observations of galactic nonthermal radio radiation, and the spectrum of galactic cosmic ray electrons. (IAA)

20698 INTERSTELLAR NEUTRAL HYDROGEN AND ITS SMALL-SCALE STRUCTURE. Verschuur, G. L. (Univ. of Colorado, Boulder). pp 27-50 of Galactic and Extra-Galactic Radio Astronomy. Verschuur, G. L.; Kellermann, K. I. (eds.). New York; Springer-Verlag (1974).

Topics include the 21-cm emission line and the emission spectrum of neutral hydrogen, the differences between the absorption and emission spectra, the presentation of 21-cm data, the causes of small-scale structure in the interstellar HI, clusters and regions of emission, the Orion region, the effect of dust, the presence of other atoms, 21-cm absorption experiments, nonplanar neutral hydrogen, temperature and distribution of the gas, high-resolution studies, anomalous velocity neutral hydrogen, high-velocity clouds, and others. Recent data serve as an illustration of the topics discussed. (IAA)

20699 RADIO CHARACTERISTICS OF HII REGIONS AND THE DIFFUSE THERMAL BACKGROUND. Gordon, M. A. (National Radio Astronomy Observatory, Green Bank, WV). pp 51-81 of Galactic and Extra-Galactic Radio Astronomy. Verschuur, G. L.; Kellermann, K. I. (eds.). New York; Springer-Verlag (1974).

The properties and the emission mechanisms of the HII regions are discussed. Topics covered are ionized interstellar hydrogen, emission nebulae, the diffuse thermal background, radiation transfer, bremsstrahlung, absorption and emission coefficients, radio recombination lines, line frequencies and shape functions, transfer equations, physical characteristics of HII regions, LTE and departures from LTE, Stark broadening, diffuse regions and pulsar dispersion, turnover frequencies, anomalous recombination lines, relative abundances of helium and hydrogen, and observation studies. (IAA)

20700 LARGE-SCALE DISTRIBUTION OF NEUTRAL HYDROGEN IN THE GALAXY. Burton, W. B. (National Radio Astronomy Observatory, Green Bank, WV). pp 82-117 of Galactic and Extra-Galactic Radio Astronomy. Verschuur, G. L.; Kellermann, K. I. (eds.). New York; Springer-Verlag (1974).

Subjects covered include the kinematics of galactic neutral hydrogen, differential galactic rotation, deviations from circular symmetry and circular motions, noncircular motions as predicted by the linear density-wave theory, determination of galactic structure from hydrogen observations, line profile characteristics due to geometric effects, kinematic distributions, the model-making approach to large-scale structure, the neutral hydrogen layer, the presence of neutral hydrogen in the galactic nucleus, and radial motions in the central region. The discussion proceeds from a study of observational data presented in contour maps. (IAA)

20701 SUPERNOVA REMNANTS. Hogg, D. E. (National Radio Astronomy Observatory, Green Bank, WV). pp 118-139 of Galactic and Extra-Galactic Radio Astronomy. Verschuur, G. L.; Kellermann, K. I. (eds.). New York; Springer-Verlag (1974).

The optical properties of supernovae determined from observation of extragalactic objects are reviewed, and the better known remnants are described. Some headings are the identification of remnants in the Galaxy, classification of supernovae, the Crab nebula and the Crab pulsar, the remnant Cassiopeia A, and supernova remnants within the Galaxy. The radio properties and the evolution of remnants is discussed along with questions of distribution and energy balance. (IAA)

20702 PULSARS. Manchester, R. N. (National Radio Astronomy Observatory, Green Bank, WV). pp 140-158 of Galactic and Extra-Galactic Radio Astronomy. Verschuur, G. L.; Kellermann, K. I. New York; Springer-Verlag (1974).

The observed properties of pulsars, both intrinsic and resulting from propagation effects in the interstellar medium, are discussed. Subjects include pulse period, dispersion, pulse shape, radio spectrum, optical and x-ray spectra, amplitude fluctuations, drifting subpulses, periodic fluctuations, nulls, scintillation, characteristic fluctuation times and bandwidths, pulse smearing, polarization, integrated observations, correlation of pulsar properties, pulsar models, rotating neutron stars, magnetic dipole radiation, radio and optical emission mechanisms, and period discontinuities. (IAA)

20703 GALACTIC MAGNETIC FIELD. Verschuur, G. L. (Univ. of Colorado, Boulder). pp 179-198 of Galactic and Extra-Galactic Radio Astronomy. Verschuur, G. L.; Kellermann, K. I. (eds.). New York; Springer-Verlag (1974).

Theory and data on the galactic magnetic field are presented. The discussion covers observation of the field, the Faraday effect, background polarization and depolarization, ionospheric effects, rotation measure data, interpretation of background polarization surveys, Zeeman effect data, the structure of the magnetic field, the helical field, the magnetic field strength, pulsar rotation measure data, and related subjects. (IAA)

20704 INTERSTELLAR MOLECULES. Turner, B. E. (National Radio Astronomy Observatory, Green Bank, WV). pp 199-255 of Galactic and Extra-Galactic Radio Astronomy. Verschuur, G. L.; Kellermann, K. I. New York; Springer-Verlag (1974).

The properties of interstellar molecules are discussed, with emphasis on the observational aspect, the regions where such molecules are found, and the physical conditions that can be deduced from those species that are normally excited. Topics include the observation of interstellar molecules at radio wavelengths, observations at optical and UV wavelengths, microwave molecular observations as probes of interstellar clouds, the implications of missing molecules, and the formation and destruction of interstellar molecules. (IAA)

20705 MAPPING NEUTRAL HYDROGEN IN EXTERNAL GALAXIES. Wright, M. C. H. (National Radio Astronomy Observatory, Green Bank, WV). pp 291-319 of Galactic and Extra-Galactic Radio Astronomy. Verschuur, G. L.; Kellermann, K. I. New York; Springer-Verlag (1974).

The development of high-resolution methods of mapping neutral hydrogen is discussed, and the existing observational data is surveyed. Topics include classification systems for galaxies, integral properties of galaxies, luminosity and total mass, selection effects, correlations, mapping HI in galaxies, density and velocity distributions, observations with a single disk, Magellanic clouds, model fitting, interferometric observations, aperture synthesis observations, data reduction, high-resolution maps, large and small-scale structure, rotation curves and total mass, velocity fields and streaming motions, and others. (IAA)

20706 RADIO GALAXIES AND QUASARS. Kellermann, K. I. (National Radio Astronomy Observatory, Green Bank, WV). pp 320-352 of Galactic and Extra-Galactic Radio Astronomy. Verschuur, G. L.; Kellermann, K. I. New York; Springer-Verlag (1974).

Radio emission from galaxies and quasars and the principles of synchrotron emission are discussed. The subjects treated are the radio surveys, optical identifications, radio properties, spectra and intensity variations, theories of radio sources, the effect of energy losses on synchrotron radiation, interpretation of spectral

data, effect of absorption by ionized hydrogen, inverse Compton scattering, energy considerations, polarization, time variations, and the evolution of the radio sources. (IAA)

Cosmology

Refer also to abstracts 20602, 20603, 20687, 21425, and 21428.

20707 SIGNIFICANCE OF THE ANGULAR DIAMETER-REDSHIFT RELATION. Roeder, R. C. (Univ. of Toronto, Ont.). Nature (London)., 255: No. 5504, 124-125(8 May 1975).

Reference is made to Hewish et al (Nature 252 : 657 (1974)) who stated that interplanetary scintillation techniques indicate an absence of small-diameter sources at the largest redshifts, and discussed the cosmological implications of this using standard homogeneous Friedmann models of the universe. The present author here points out the important effects on the angular diameter-redshift relation caused by small scale inhomogeneities. (UK)

20708 THE AMOUNT OF MATTER IN A MATTER-ANTIMATTER MODEL OF THE UNIVERSE. Aly, J. J. (CEN de Saclay, Gif-sur-Yvette, France); Valladas, G.; Caser, S.; Omnes, R.; Puget, J. L. Astron. Astrophys., 35: No. 2, 271-281(Oct 1974).

30 refs.

One reconsiders the calculation of the amount of matter in a matter-antimatter symmetric universe, assuming some symmetry breaking due to a phase separation of matter from antimatter at high temperatures. The original calculation by Omnes was subjected to two main criticisms: Zeldovich has called attention to the importance of initial correlations while Steigman has pointed out the determinant role of neutron diffusion in annihilation. These two effects, and several others, are included and further analyzed. It turns out that the final amount of matter that is found is lower than observed in a perfectly quiet universe, as noticed by Zeldovich. However it is also found that any small amount of initial turbulence (with velocities larger than 4×10^2 cm/s at a time 10^{-5} s), is enough to break the initial correlations and gives exactly the observed amount of matter. Some past conclusions as to the absence of helium synthesis in the model are withdrawn. (GE)

20709 ON THE EQUATIONS GOVERNING THE PERTURBATIONS OF THE SCHWARZSCHILD BLACK HOLE. Chandrasekhar, S. (Univ. of Chicago). Proc. R. Soc. (London), Ser. A, 343: No. 1634, 289-298(13 May 1975).

A coherent self-contained account of the equations governing the perturbations of the Schwarzschild black hole is given. In particular, the relations between the equations of Bardeen & Press (J. Math. Phys., 14: 7 (1973)), of Zerilli (Phys. Rev. Lett., 24: 737 (1970) and Phys. Rev., D2: 2141 (1970)) and of Regge & Wheeler (Phys. Rev., 108: 1063 (1957)) are explicitly established. (auth)

20710 NONLINEAR THEORY OF THE DEVELOPMENT OF POTENTIAL PERTURBATIONS. Doroshkevich, A. G.; Ryaben'kii, V. S.; Shandarin, S. F. (Inst. of Applied Mathematics, Moscow). Astrophysics., 9: No. 2, 144-153(1973).

Translated from Astrofizika; 9: No. 2, 257-272(1973).

The development of potential-type perturbations under the influence of a gravitational instability from small amplitudes to the formation of objects of high density is investigated analytically and numerically. In the neighborhood of the forming objects, the motion of the matter is nearly one-dimensional and can be well described by the approximate solution of the equations of hydrodynamics (at $p = 0$) and gravitation proposed previously. The proposed method of analytic estimation of the accuracy of the approximate solution is based on a comparison of the principal values of the deformation tensor, and the relation between it and results of numerical calculations is discussed. (auth)

20711 GRAVITATIONAL COLLAPSE IN THE PROJECTIVE THEORY OF RELATIVITY. Kallio, H. (Aarne Karjalainen Observatory, Oulu, Finland). Physica; No. 414, 1-9(1974).

The equations describing in Jordan's projective theory of relativity (1952) the geometry outside a collapsing spherically symmetric mass distribution are studied. They are found to have also a time independent solution, which coincides with Heckmann's solution. As an application the free-fall collapse of a star in Heckmann's geometry is examined. It is shown to stop after a finite elapse of time and to turn into an expansion. (auth)

20712 THE EFFECT OF MASS-FORMULA ON THE R-PROCESS PRODUCT. Kitchman, E. M.; Kozlovsky, B. Z.; Shaviv, G. (Tel Aviv Univ. (Israel). Dept. of Physics and Astronomy). Astron. Astrophys., 35: No. 3, 345-351(Oct 1974).

3 figs.; 1 tab.; 12 refs.

The new mass formula derived by Garvey et al. (1969) is examined by comparing the r-process abundance prediction and observation. The various relevant assumptions are stated. It is concluded that with this formula the prediction of the r-process conforms best with observation. A correction to the mass formula that improves the agreement further is proposed. (auth)

20713 TILTING AT COSMOLOGICAL SINGULARITIES. Collins, C. B. (Oxford Univ. (UK). Dept. of Astrophysics; Trinity Coll., Oxford (UK)). Commun. Math. Phys., 39: No. 2, 131-151(Dec 1974).

5 figs.; 1 tab.; 24 refs.

A detailed investigation is made of the simplest type of general relativistic perfect fluid cosmological models that possess a singularity at which all physical quantities are well-behaved. These models are spatially homogeneous, axisymmetric generalisations of the open ($k = -1$) Robertson-Walker universes. A pictorial description of the evolution of the models is obtained by using the qualitative theory of differential equations. The most surprising feature that emerges is that for some (non-empty) models the matter density may become zero, within a finite time, on a null hypersurface which acts as a Cauchy horizon for the models. This result is generalized to most other types of spatially homogeneous models. It is also discovered that the behaviour of the models varies dramatically with the type of matter content. This casts some doubts on the validity of assuming definite equations of state in general relativity, and suggests an investigation of the structural stability of Einstein's field equations. (auth)

20714 EVOLUTION AND AGE OF ANISOTROPIC COSMOLOGICAL MODELS WITH COSMOLOGICAL CONSTANT. Kubo, M. Publ. Astron. Soc. Jap., 26: No. 3, 355-359(Sep 1974).

The evolution and the age of anisotropic cosmological models with cosmological constant containing dustlike matter are examined by means of the density parameter σ and the anisotropy parameter α. It is shown that such models evolve from an anisotropic empty model which remains fixed at a point $(0, \frac{1}{2})$ on the (σ, α) plane as the cosmic time elapses. The effect of anisotropy on the age of these models is also discussed. (auth)

20715 PRINCIPLE OF IMPOTENCE ALLOWING FOR NEWTONIAN COSMOLOGIES WITH A TIME-DEPENDENT GRAVITATIONAL CONSTANT. Landsberg, P. T.; Bishop, N. T. (Southampton Univ., Eng.). Mon. Not. R. Astron. Soc., 171: No. 2, 279-286(May 1975).

A principle of impotence is given. Subject to some additional assumptions, it leads for Newtonian cosmologies to a gravitational interaction of the form $\nu(r, t) = -m_1 m_2 [(1/r) + Dr^j] G(t)$, where the gravitational "constant" $G(t)$ is related to the Hubble constant $H(t)$ by $G(t) = \exp[-j \int^t H(t)\, dt]$, and j is a constant. This allows for the normal zero-pressure Friedmann cosmologies, the Dirac cosmology and also other models not previously considered. Comparison with observation restricts the likely values of j to the range $-1 < j < 4$. (auth)

20716 INTERSTELLAR CARBON I LINES IN ZETA OPHIUCHI. de Boer, K. S. (Rijksuniversiteit, Groningen, Netherlands); Morton, D. C. pp 35-55 of Interstellar Absorption Lines in the Ultraviolet. de Boer, K. S. (ed.). Groningen; Rijksuniversiteit (20 Dec 1974).

With the help of two new f-values of CI lines obtained from the spectra of ζ Pup and γ^2 Vel, we show that the interstellar CI spectrum in ζ Oph obeys an optical-depth relation similar to the one observed with Na I. From this, the relative strengths for 19 multiplets are determined. Populations of the fine-structure levels as a function of n_H and T are calculated. From these data we find evidence that the CI lines are formed in the dense cloud in front of ζ Oph at a heliocentric velocity of -14.4 km s^{-1}. The observed column-density ratios of the C^0 fine-structure levels lead to a total density of H nuclei $n_H \approx 220$ to 660 cm^{-3} since $N_{H_2} \approx N_{H_2}$. However, the electron density and observed C^+ abundance imply $n_{H_2} \approx 10^4$ cm^{-3}, with a gas layer of 0.05 pc thick. (NL)

20717 MEASUREMENTS OF INTERSTELLAR ABSORPTION LINES BETWEEN 3241 AND 3969 A. de Boer, K. S.; Pottasch, S. R. (Rijksuniversiteit, Groningen, Netherlands). pp 29-34 of Interstellar Absorption Lines in the Ultraviolet. de Boer, K. S. (ed.). Groningen; Rijksuniversiteit (20 Dec 1974).

Profiles for the interstellar CaIIK absorption lines towards a Car, 1 Sco, χ Oph, HD 154090 and γ Ara. as well as some results on interstellar TiII and CN are presented. (NL)

20718 OBSERVATIONS OF THE INTERSTELLAR Na 3302 DOUBLET AND THE INTERSTELLAR SODIUM ABUNDANCE. de Boer, K. S.; Pottasch, S. R. (Rijksuniversiteit, Groningen, Netherlands). pp 21-27 of Interstellar Absorption Lines in the Ultraviolet. de Boer, K. S. (ed.). Groningen; Rijksuniversiteit (20 Dec 1974).

Observations are presented of the interstellar neutral sodium

UV doublet at 3302 Å (to be called Na U doublet). Together with the scarce U line data in the literature, these form the basis for deriving accurate Na column densities, which are an order of magnitude larger than values derived from the D lines alone. After allowance for ionization balance we find total sodium to hydrogen is close to the solar abundance value. Using both doublets (U and D) we find that the internal Doppler velocities are of the order of 1-3 kms^{-1} in most clouds. (NL)

20719 ON THE COMPOSITION OF THE INTERSTELLAR GAS TOWARDS ZETA PUP. de Boer, K. S.; Pottasch, S. R. (Rijksuniversiteit, Netherlands). pp 13-16 of Interstellar Absorption Lines in the Ultraviolet. de Boer, K. S. (ed.). Groningen; Rijksuniversiteit (20 Dec 1974).

UV-interstellar absorption lines measured in the direction of ζ Pup by the S 59 satellite spectrograph are presented. These data are combined with other interstellar line measurements in the same star, to derive a curve of growth and element abundances. (NL)

20720 ON THE PHOTOIONIZATION RATES IN INTERSTELLAR GAS. de Boer, K. S.; Pottasch, S. R. (Rijksuniversiteit, Groningen, Netherlands). pp 11-12 of Interstellar Absorption Lines in the Ultraviolet. de Boer, K. S. (ed.). Groningen; Rijksuniversiteit (20 Dec 1974).

Photoionization rates in the interstellar gas are calculated using OAO-2 data for the interstellar radiation density. A comparison is given with earlier results. (NL)

20721 COSMOLOGY. von Hoerner, S. (National Radio Astronomy Observatory, Green Bank, WV). pp 353-392 of Galactic and Extra-Galactic Radio Astronomy. Verschuur, G. L.; Kellermann, K. I. New York; Springer-Verlag (1974).

Some of the current problems in cosmology are discussed, basic concepts are stated, and key definitions are introduced. The discussion covers such matters as observables and their standards, objects vs world, quasars and cosmological distance, spaces, times, metrics, horizons, red shifts, matter and antimatter, world models, general relativity, expansion types and singularities, optical observations and radio observations, and observational tests and theories. (IAA)

Planetary Phenomena

Refer also to abstracts 19235, 20657, 20669, 20670, 20861, and 21338.

20722 (N-74-34269) DATA CATALOG OF SATELLITE EXPERIMENTS. Supplement 2B: Particles and Fields. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). Oct 1974. 93p. (NASA-TM-X-72528). NTIS $7.75.

Each data set contained in this catalog lists spacecraft characteristics, experiment personnel, and a brief description of particle and field experiments. (STAR)

20723 (N-74-34578) ELEMENTAL ABUNDANCES IN METEORITIC AND TERRESTRIAL MATTER. Annual Progress Report, 1 September 1973-31 August 1974. Schmitt, R. A. (Oregon State Univ., Corvallis (USA). Dept. of Chemistry). 31 Aug 1974. 51p. (NASA-CR-140627). NTIS $5.75.

Major and trace element analyses of over 180 individual chondrules from 12 carbonaceous chondrites are reported, including individual analyses of 60 chondrules from Pueblito de Allende. Siderophile elements in most chondrules are depleted, compared to the whole chondrite. Correlations of Al-Ir and Ir-Sc among chondrules high in Ca and Al were observed. A Cu-Mn correlation was also found for chondrules from some meteorites. No correlation was observed between Au and other siderophile elements (Fe, Ni, Co and Ir). It is suggested that these elemental associations were present in the material from which the chondrules formed. Compositionally, chondrules appear to be a multicomponent mixture of remelted dust. One component displaying an Al-Ir correlation is identified as Allende-type white aggregates. The other components are a material chemically similar to the present matrix and sulfides-plus-metal material. Abundances of the REE (rare earth elements) were measured in ordinary Allende chondrules and were 50 percent higher than REE abundances in Mokoia chondrules; REE abundances in Ca-Al rich chondrules were similar to REE abundances in Ca-rich white aggregates. (auth)

20724 (N-75-10889) IS JUPITER'S MAGNETOSPHERE LIKE A PULSAR'S OR EARTH'S. Kennel, C. F.; Coroniti, F. V. (California Univ., Los Angeles (USA). Plasma Physics Group). Sep 1974. 67p. (NASA-CR-140600). NTIS $4.25.

The application of pulsar physics to determine the magnetic structure in the planet Jupiter outer magnetosphere is discussed. A variety of theoretical models are developed to illuminate broad areas of consistency and conflict between theory and experiment. Two possible models of Jupiter's magnetosphere, a pulsar-like radial outflow model and an earth-like convection model, are examined. A compilation of the simple order of magnitude estimates derivable from the various models is provided. (auth)

20725 (UCRL-76755) NEW MODEL FOR THE LUNAR INTERIOR TO 250 km. Piwinskii, A. J.; Duba, A. G. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 7 May 1975. 24p. (CONF-750344-1). Dep. NTIS $4.00.

From 6th lunar science conference; Houston, Texas, USA (17 Mar 1975).

A new model for the structure of the lunar interior to about a 250-km depth is proposed. It is suggested that this region is composed of plagioclase-bearing rocks, and that the 65-km seismic discontinuity represents the appearance of garnet. A variety of rock types mainly composed of plagioclase, pyroxene, olivine and garnet is envisioned, with at least half of the outer 250 km of the moon made of plagioclase, which dominates the electrical conductivity. This model agrees with recent petrological and electrical conductivity results and does not violate velocity-depth profiles obtained from elastic-wave studies of lunar and terrestrial materials. (auth)

20726 ANALYSIS OF TUNG-T'AI METEORITE. Wang, H. Y.; Li, H. C.; Wang, S. C. Tien Wen Hsueh Pao; 15: No. 1, 93-97(Apr 1974). (In Chinese).

Tung-t'ai meteorite happened to fall in Tung-t'ai Hsien, Kiangsu Province on 20 January 1970. It is a kind of chondrite, weighing 5500 grams. The structure of various chondrules of this meteorite, the resulting data of mineralogical and chemical analysis, and its potassium-argon age are presented. (JPRS)

20727 CHEMICAL NATURE OF SUPERHEAVY ELEMENT IN METEORITES. Goncharov, G. N. (Leningrad State Univ.). Dokl. Akad. Nauk SSSR; 220: No. 3, 552-555(21 Jan 1975). (In Russian).

For an examination of the question of the chemical nature of the element whose fissioning is related to the surplus of heavy Xe isotopes in meteorites, factor analysis in the primary component model was used which made possible the spectral resolution of correlation matrices with separation of the interaction between elements created in individual processes. The reduced correlation coefficients between fission-produced ^{136}Xe and other indicators are tabulated. The dependence of the entropy on the atomic number was established and the thermodynamic properties of the superheavy element evaluated. The values were close to those anticipated for element 113. (2 figures, 1 table) (JSR)

20728 NOTE ON THE PERIHELION ADVANCE OF PLANETS. Kar, K. C.; Bhattacharyya, A. K. (Inst. of Theoretical Physics, Calcutta). Indian J. Theor. Phys.; 22: No. 1, 35-39(Mar 1974).

The problem of planetary motion in a central field is studied by Lagrange's method. It is shown that the classical approach gives the classical formula for this problem, while the simple relativistic approach (approximate or rigorous) gives the well-known Einstein formula for perihelion advance (l.c.). (auth)

20729 SPECTRA OF HIGH-FREQUENCY RADIO EMISSION FROM JUPITER. Groth, M. J.; Dowden, R. L. (Otago Univ., Dunedin, New Zealand). Nature (London).; 255: No. 5507, 382-384(29 May 1975).

Observations are described, made over the period May 1972 to October 1974 from the Otago field site near Dunedin, of Jupiter's high frequency radio emissions. The frequency range of 23 to 25 MHz was reduced to a 2 MHz video signal that was recorded on videotape and analysed with a high resolution spectrum analyser to produce the spectrum of the ms radio bursts. Most of the emissions occurred in three burst groups lasting a total of less than 5 min., the strongest burst group lasting about 30 sec. The data obtained were consistent with an earlier prediction of cyclotron radiation from bunches of electrons moving along the spatially varying magnetic field of the planet. Multiple bursts were common during periods of high emission rate, and these are discussed. A considerable amount of fine structure was observed in the spectra. (UK)

20730 INVESTIGATION OF METEOR STREAM AGES. Korpikiewicz, H. (Obserwatorium Astronomiczne Uniwersytetu, Poznan, Poland). Postepy Astron.; 23: No. 1, 69-71(1975). (In Polish).

The average distance between the orbit of a comet and of a meteor may serve as a stream age indicator. Computations suggest a genetic relation between the α-Capricornidae and the Leksel 1770 I comet, which seems to settle the controversy as to the origin of that stream. (auth)

20731 COSMIC RAYS UNDERGROUND AND THE INTERPLANETARY MAGNETIC FIELD. Regener, V. H. (New Mexico Univ., Albuquerque (USA). Dept. of Physics and Astronomy);

Regener, E. (Montreal Univ., Quebec (Canada). Faculte de Musique). J. Geophys.; 40: No. 6, 761-766(Dec 1974).
1 fig.; 2 tabs.; 4 refs.

A multiple regression analysis is performed between the harmonic components of the underground cosmic-ray flux and the three components of the interplanetary magnetic field vector as measured by spacecraft. A significant linear regression is found between a cosmic-ray diurnal variation with a maximum at 6h or at 18h sidereal time, and the magnetic field component tangential to the earth's orbit. (GE)

20732 ADDITIONAL EVIDENCE FOR A POSSIBLE EMISSION OF COSMIC RAYS BY JUPITER. Pizzella, G. (Univ., Rome). Lett. Nuovo Cim.; 13: No. 5, 179-180(31 May 1975).

Attention is called to the fact that the Pioneer X particle and field data obtained with measurements in the interplanetary space seem to corroborate the idea that Jupiter is a cosmic ray source in the solar system. The information which can be obtained with the magnetic field data is discussed. (JFP)

20733 STRONGLY-COOLED IONIZING PLASMA FLOWS WITH APPLICATION. Wallis, M. K.; Ong, R. S. B. (Oxford Univ.). Planet. Space Sci.; 23: No. 4, 713-721(Apr 1975).

When the solar wind penetrates into an atmosphere of hydrogen or helium, symmetric charge exchange interactions give energy and momentum losses as the dominant source terms in the flow equations. One-dimensional, supersonic to subsonic solutions are available if the cooling is strong enough. In a model with transverse field and adiabatic (non-thermal) ions, a range of weakly-shocked solutions with upstream mach number less than 2.5 are discovered. As in the case of detonation waves, the shock strength is independent of downstream boundary conditions. The solutions may apply in the solar wind flow into the Venusian atmosphere. (auth)

20734 WAVELENGTH DEPENDENCE OF THE ALBEDOS OF URANUS AND NEPTUNE FROM 0.3 TO 1.1 MICRON. Wamsteker, W. (National Aeronautics and Space Administration, Huntsville, AL). Astrophys. J.; 184: 1007-1016(15 Sep 1973).

Narrow-band photoelectric photometry was made of Uranus and Neptune over a wavelength interval from 0.3 to 1.1 μ. The wavelength dependence of the geometric albedo was determined for these planets. Evidence is given that the comparison star used resembles the Sun very closely in its energy distribution. It is shown that, apart from methane, another opacity source seems to be necessary in the atmospheres of these planets to explain the observed wavelength dependence of the geometric albedo for the two planets simultaneously. Radiative transfer calculations were made to determine if the previously suggested pressure-induced dipole absorptions of H_2 result in a self-consistent explanation. This seems to be the case. The H_2 abundance in this case is limited for both planets between 350 km amagat $\leq N(H_2) <$ 800 km amagat. This agrees with a previous determination of the H_2 abundance for Uranus. The relative CH_4 abundance is determined from the observations; the actual value depends on the saturation in the absorptions. This does not agree with previous determinations. (NL)

20735 INTRODUCTION AND HISTORY, INSTRUMENTATION AND CALIBRATION, THE GALILEAN SATELLITES AND SATURN'S RINGS, AND OBSERVATIONS OF SATURN AND TITAN. Wamsteker, W. (Rijksuniversiteit, Leiden). pp 1-58; 67-82; 93-106 of Spectrophotometric Study of the Major Planets and Their Large Satellites. Leiden; Rijksuniversiteit (5 Feb 1975).

Narrow-band photoelectric photometric measurements were made of the four biggest Jupiter satellites, the rings of Saturn, the Saturn Satellite Titan, Saturn at 3 latitudes and Uranus and Neptune. The wavelength dependence of the geometric albedo was determined in the interval from 0.3 to 1.1μ. Evidence is given that the comparison star used (35 Leo) resembles the sun very closely in its energy distribution. On basis of the observed spectra it is concluded that a considerable fraction of the surface of the inner Jupiter satellite Io is covered with molecular sulfur. The spectra of the other three Jupiter satellites are very similar to that of the Saturn rings. This has been shown by others to be very similar to the spectrum of H_2O frost contaminated by H_2S after exposure to ultraviolet light. With respect to the Uranus and Neptune atmospheres good agreement is obtained assuming a hydrogen abundance of about 500 km amagat in a clear isothermal atmosphere overlaying a grey cloud layer with an albedo of about 0.8. The spectra of Saturn and Titan show apparent inconsistencies in the equivalent width of different CH_4 absorptions for these objects. (NL)

PHYSICS (ATMOSPHERIC)

Auroral and Ionospheric Phenomena

Refer also to abstracts 20568, 20588, 20771, and 20774.

20736 (AD/A-001390) DIRECTION FINDING MEASUREMENTS OF AURORAL KILOMETRIC RADIATION. Progress Report. Kurth, W. S.; Baumback, M. M.; Gurnett, D. A. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy). Oct 1974. Contract N00014-68-A-0196-0009. 37p. NTIS $3.75.

Direction finding measurements with plasma wave experiments on the Hawkeye-1 and IMp-8 satellites are used to locate the source region of auroral kilometric radiation. This radiation has peak intensities between about 100 khz and 300 khz and is emitted in intense sporadic bursts lasting for from half an hour to several hours. At peak intensity the total power emitted in this frequency range exceeds 10 to the 9th power watts. The occurrence of this radiation is known to be closely associated with bright auroral arcs which occur in the local evening auroral regions. (GRA)

20737 (AD/A-002317) AURORAL DATA ANALYSIS. Final Report, 1 March 1972-30 June 1974. Heikkila, W. J.; Winningham, J. D. (Texas Univ., Dallas (USA). Richardson Center for Advanced Studies). 30 Sep 1974. Contract F19628-72-C-0230. 44p. (AFCRL-TR-74-0379). NTIS $3.75.

Data from the soft particle spectrometers on the ISIS-1 and -2 satellites were reduced, analyzed, and compared with other observations to reveal auroral and ionospheric effects. The satellite observations confirm Pike's suggestion that the regions of auroral particle precipitation are characterized by strong ionospheric f region irregularities, which can be observed and monitored by ionosondes or HF radars. The magnetospheric cleft or dayside auroral region moves to lower latitudes when the interplanetary magnetic field turns southward but also in direct and rapid response to nightside auroral substorm activity. The polar cap is generally subject to a uniform and weak polar rain or flux of magnetosheath plasma, as well as localized bursts or showers. During major geomagnetic storms there is a greatly enhanced precipitation of electrons with several keV energies, called a polar squall. The nightside expansion phase precipitation pattern is complex, but a characteristic pattern is correlated with substorm time or phase, the poleward motion being followed by a collapse or weakening of the electron flux behind it. (GRA)

20738 (CONF-720805-P1, pp 55-67) COSMIC RAY IONIZATION IN THE LOWER ATMOSPHERE. Liboff, A. R. (Oakland Univ., Rochester, MI). 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Different measurements of the ionization density in the atmosphere are discussed. Recent measurements using large-volume ionization chambers with different fill gases and wall constructions are described. To eliminate background, the measurements were made at the surface of fresh water lakes, well away from gammas from the shoreline. A table of results from 1965 of various United States locations is presented. (9 figs, 2 tables, 20 refs.) (GHT)

20739 (CONF-720805-P2, pp 705-715) ROLE OF NATURAL RADIATION ENVIRONMENT IN ATMOSPHERIC SCIENCES. Vohra, K. G. (Bhabha Atomic Research Center, Bombay). 1972.

From second conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

The effect of natural ionizing radiations on the formation of embryos of nucleation, ionizing radiation, including terrestrial beta and gamma rays, radon and thoron in the air, cosmic radiation, x-rays, and ultraviolet, are discussed for various levels of the atmosphere from sea level to 50-400 km above sea level. Early observations of the role of radon and thoron in nucleus formation are covered, and recent experiments on the correlation between radon content of the air and the number of nuclei formed in the filtered air. The implications with respect to air pollution, weather phenomena, cloud formation, and aurorae are discussed. (6 figures, 16 references) (GHT)

20740 (COO-2195-12) DENSITY VARIATIONS IN THE LOWER THERMOSPHERE. Scientific Report No. 2. Johnson, W. F. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Meteorology). 19 Feb 1974. AT(11-1)-2195. 175p. Dep. NTIS $11.75.

Thesis.

Accelerometer derived thermospheric density data from the LOGACS and SPADES satellites are processed to yield the equivalent density variation at 150 and 160 km respectively. Definite latitudinal and longitudinal variations are found which conflict with Jacchia's 1971 model. Time-latitude analyses are presented of density at a single altitude. The density response to a great geomagnetic storm is nearly the same from 25°S to 85°N except that a density trough forms just equatorward of the auroral oval. Gravity waves are observed during the storm. The structure and dynamics of the lower thermosphere are far more complex than previous studies indicate. (20 figures, 11 tables, 74 references) (auth)

20741 (JINR-E9-8315) MECHANISMS OF ENERGY TRANSFORMATION AT THE FORMATION OF WHISTLER SOLITONS. Bogolubskii, I. L.; Makhankov, V. G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1974. 13p. Dep. NTIS (US Sales Only) $4.00.

The processes of formation and interaction of whistler solitons are considered. The principle process is shown to be the generation of ion-sound waves. The possibility is discussed of a new channel of turbulent dissipation of H. F. energy, associated with pair whistler soliton collisions. (2 figures) (auth)

20742 (TRITA-EPP-74-14) ELECTRIC FIELD AND PLASMA MEASUREMENTS IN THE AURORAL IONOSPHERE PRIOR TO A MAGNETIC SUBSTORM. Fahleson, U.; Faelthammar, C.-G.; Pedersen, A. (Kungliga Tekniska Hoegskolan, Stockholm (Sweden). Institutionen foer Plasmafysik). Jun 1974. 10p. Dep. NTIS (US Sales Only) $4.00.

Electric field and Langmuir probe experiments flown on a rocket from ESRANGE prior to a substorm show characteristic changes of the electric field and ionospheric plasma in connection with the appearance of weak auroral activity overhead. The electric field, which is initially about 40 mV/m and northerly, decreases to 20 mV/m and turns temporarily eastward by 15°. Simultaneously plasma density and temperature increases are observed. (auth)

20743 (WRE-TM-A-247(AP)) COMPARISON OF ADCOCK BEARING OBSERVATIONS ON REMOTE TARGETS WITH LOCAL SHORT CELL OBSERVATIONS OF TID'S. George, P. L.; Booth, D.; Miller, A. J. (Weapons Research Establishment, Salisbury (Australia)). Mar 1974. 14p. Dep. NTIS (US Sales Only) $4.00.

One of the objectives of the W. R. E. research program on TID's is to investigate the degree to which local s.s.l. observations of TID's can be used to correct Adcock bearing observations on remote targets. This paper discusses some preliminary experimental observations directed towards this objective. The results relate to hand-rocked bearing observations using an Adcock on a keyed tone time transmission located 706 km south east of the St. Kilda field site. Large bearing variations on a path of 700 km in length and at 7.5 MHz in daylight hours were observed. (AT)

20744 RADIATION BELT ELECTRON PRECIPITATION AND ITS IONOSPHERIC EFFECTS AT MIDDLE LATITUDES. Spjeldvik, W. N. Los Angeles; Univ. of California (1974). 165p. University Microfilms Order No. 75-9436.

Thesis (Ph. D.).

The role of radiation belt electron precipitation into the Earth's atmosphere at middle geomagnetic latitudes is studied. First, the process of pitch angle scattering of energetic electrons in the radiation belts is modeled, and the flux angular distributions are obtained for all pitch angles, including the atmospheric bounce loss cone. This determines the angular distribution of the precipitating fluxes. Secondly, the interaction of these fluxes with the ambient atmospheric constituents is simulated, using the Fokker-Planck method; and the rate of energy deposition in the atmosphere is calculated at any given height. This gives rise to a significant rate of ion pair production in the lower ionosphere. Thirdly, the influence of this precipitation induced ionization on the structure and composition of the ionospheric D-region is modeled. Two specific classes of electron precipitation are studied; one is the quiet time "drizzle" occurring in the absence of geomagnetic disturbances; the second is the storm-time precipitation during the recovery phase of major geomagnetic storms with its substan-

tial impact on the lower ionosphere. Computations are furthermore carried out for geomagnetically quiet times, and the results indicate that the electron precipitation can provide the dominant nocturnal ionization source for the D-region in a narrow belt of geomagnetic latitudes corresponding to the inner edge of the outer radiation zone (L approximately 4 to 5; LAMBDA approximately 60^0 to 65^0) with ion pair production rates typically between 0.1 and 1 ion pair cm^{-3} sec^{-1} from about 60 to 90 kilometers at L equals 5. (auth)

20745 HYDROGEN IN THE UPPER ATMOSPHERE. Tinsley, B. A. (Univ. of Texas, Dallas). Fundam. Cosmic Phys.; 1: No. 3, 201-300(1974).

Theoretical altitude distributions are examined, taking into account D and E region density distributions, relations between escape and exospheric density distributions, and aspects of thermospheric distributions and changes with exospheric temperature. Theoretical diurnal variations are considered along with ion-neutral interactions, radiative transfer theory, optical observations, non-optical observations, aspects regarding the altitude profile of deuterium, the ionization of the night time D and E regions, and the effect of hydrogen loss on oxygen evolution. Questions concerning the presence of H and D around other planets are also investigated, giving particular attention to Venus, Mars, and Jupiter. (IAA)

20746 If AND vlf PHASE ANTINOMIES DURING SOLAR X-RAY FLARES. Perona, G. E. (Istituto di Elettronica e Telecommunicazioni, Turin). Radio Sci.; 10: No. 4, 435-444 (Apr 1975).

During solar x-ray flares the phases of vlf and lf signals reflected from the ionosphere at grazing incidence often show an opposite behavior, the so-called phase antinomy. Two years of data have been analyzed to show the main characteristics of this phenomenon and, in particular, its seasonal dependence. An explanation of such behavior is sought in terms of changes in the phase of the ionospheric reflection coefficient. Only simple models of electron density distributions with height are numerically analyzed, namely, perturbed exponentials. (auth)

20747 RADIATION FROM NONUNIFORM CHARGED PARTICLE BEAMS IN IONOSPHERIC PLASMAS. Baker, D. J. (Naval Research Lab., Washington, DC). Radio Sci.; 10: No. 4, 473-484(Apr 1975).

The radiation from a class of nonuniform charged particle beams of finite dimensions moving through a magnetoplasma is studied. The beam structures include bunched beams which could result from natural interaction of plasma-supported waves with the beam particles or those which could be generated by spacecraft-borne particle accelerators. The generation of narrow band noise by beam structures generated by whistler wave-beam particle interaction is illustrated. It is also shown how radiation by bunched particles remains finite in regions of refractive index resonances regardless of how slowly the particles move in contrast to the theoretical result for radiation from individual particles which unrealistically gives infinite radiated power. The theory developed includes thermal effects, including temperature anisotropy for the electrons and ions. Illustrative numerical results for the special case of a single electron with zero perpendicular velocity and a large axial velocity are given using two warm plasma theories. It is shown that near the upper hybrid resonance frequency, radiation into thermal and cold plasma modes is comparable. (auth)

20748 MEASURED AND CALCULATED SECONDARY ELECTRON ENERGY SPECTRA (20-1,500 eV) ABOVE 120 km. Loidl, A.; Schlegel, K. (Max-Planck-Institut fuer Aeronomie, Lindau/Harz (F. R. Germany)). J. Geophys.; 41: No. 2, 215-218(Mar 1975).

1 tab.; 1 fig.; 8 refs.

In an altitude above 120 km recordings of vertical profiles of aeronomical parameters were obtained. Besides neutral and ion composition, electron density, airglow and thermal electron flux, the energy spectrum of electrons in the range of 20 to 1,500 eV was measured. These measurements are compared with Monte-Carlo calculations of a model ionosphere. (GE)

20749 GEOMAGNETIC CONDITIONS DURING GROUND OBSERVATIONS OF SUBPROTONOSPHERIC WHISTLERS. Raichovski, T. M. (Inst. of Geophysics, Sofia). Compt. Rend. Acad. Bulg. Sci.; 27: No. 10, 1363-1365(1974).

Observations of subprotonospheric whistlers or SP-whistlers at the observatory in Sofia (ϕ_c = 37.7° geomagnetic latitude) are reported. With an approximate experimental error of 10%, the SP components of the whistlers follow the law of dispersion, the dispersion values beginning to increase insignificantly with a decrease of frequency. The reflection of the SP-whistlers is examined as a refraction phenomenon in the presence of the medium's ion component, in which they propagate. The limited number of adduced data on the effect of geomagnetic activity upon the appearance of SP-whistlers makes it possible to draw the general conclusion that the calm state of the geomagnetic field is a factor which is indispensable for ground observations of whistlers reflected by the protonosphere. (BJG)

20750 HEATING OF THE IONOSPHERE BY AN ELECTROMAGNETIC FIELD UNDER DEVELOPED PARAMETRIC INSTABILITY. Mityakov, N. A.; Rapoport, V. O.; Trakhtengerts, V. Yu. (Scientific-Research Radiophysics Inst., Gorky, USSR). Izv. Vyssh. Ucheb. Zaved., Radiofiz.; 18: No. 1, 27-33(1975). (In Russian).

The problem of anomalous heating of the ionosphere by the electromagnetic radiation under the condition of the developed parametric instability is considered. The spatial intensity distribution of a transverse wave incident on the linear plasma layer is found. The analytical dependences of the electron temperature on time and spatial coordinate are obtained. The possibility of producing the additional ionization in the ionosphere due to electrons accelerated in the plasma wave fields is pointed out. (auth)

20751 BALLOON OBSERVATIONS OF LOW ENERGY ELECTRONS AND THE SOLAR MODULATION OF COSMIC RAYS IN INTERPLANETARY SPACE. Luhmann, J. M. G. College Park, MD; Univ. of Maryland (1974). 194p. University Microfilms Order No. 75-98.

Thesis (Ph. D.).

Balloon exposures of a large (approximately 200 cm^2 sterad) Geiger tube and scintillator hodoscope at Churchill, Manitoba, Thompson, Manitoba, and Palestine, Texas, provided records of the temporal variations of the low energy electron flux at approximately 5 g cm^{-2} atmospheric depth at three latitudes. Electrons with nominal ranges of between approximately 6 and 41 g cm^{-2} in polystyrene, which stopped in the detector, were separated from stopping nuclei on the basis of their characteristic scintillator pulse height distributions. Diurnal changes in the high latitude geomagnetic cutoffs were examined on a fine time scale (minutes) through the medium of the 14-131 MeV electron flux. The measured spectra of return albedo and atmospheric secondary electrons were independent of the launch latitude. An equation describing the modulation of the interplanetary cosmic ray distribution by the solar wind was derived using the well known quasilinear technique from plasma physics. Adiabatic deceleration results from the combination of the stochastic electric field, which is produced by the convection of magnetic irregularities at the solar wind velocity, and the diverging average magnetic field. The effects of anisotropies and the role of the magnetic spectral index in the description of solar modulation are also considered. (Diss. Abstr. Int., B)

20752 LOW FREQUENCY RADIO ASTRONOMY THROUGH AN ARTIFICIALLY CREATED IONOSPHERIC WINDOW. Papagiannis, M. D.; Mendillo, M. (Boston Univ.). Nature (London); 225: No. 5503, 42-44(1 May 1975).

The creation of an artificial ionospheric window to allow ground based low frequency radio observations is a realistic possibility. Evidence is produced indicating that a night-time injection of H_2 into the ionosphere should greatly enhance the recombination rates of free electrons and oxygen ions at all heights and thus create a vertical tube of highly reduced plasma density through the entire ionosphere. Such an artificial ionospheric window should allow radioastronomical observations to be carried out from the ground between 1 and 6 MHz, and possibly at even lower frequencies. Use of the Space Shuttle is mentioned for an occasional H_2 release over a low frequency radio observatory. On the other hand it seems that, for the next few years, the best approach might be to launch rockets carrying H_2 payloads from sites near suitable radio astronomical facilities. The Arecibo observatory could seem a suitable site. (UK)

20753 METHODS OF MEASUREMENTS AND RESULTS OF LOWER IONOSPHERE STRUCTURE. Proceedings of the Symposium Held in Constance, Germany, May 23-26, 1973. Rawer, K. (ed.). Berlin; Akademie-Verlag (1974). 471p. (CONF-7305118-). 75.- M.

The relative merits of various techniques employed for measuring concentration of electrons, ions, and neutrals, and for determining other parameters of the lower ionosphere, are compared on the basis of numerous experimental data. These experiments included electron density profile measurements, propagation measurements, and studies of winter anomaly, flare effects, local fluctuations, and gravity waves. Some of the topics covered include: construction of D-region electron density profiles by combined use of ground-based reflection and satellite-based transmission measurements, the use of VLF propagation measurements for studies of magnetospheric and meteorological influences on the lower ionosphere, the D region during solar

eclipses, ion and neutral composition measurements in the lower ionosphere, the use of LF A3 absorption measurements in studying the winter anomaly, and a meteor radar study of tides in the 80 to 100 km altitude range. (IAA)

20754 ANISOTROPY OF IONOSPHERIC IRREGULARITIES IN RELATION TO ELECTRODYNAMIC EFFECTS INDUCED BY NEUTRAL GAS MOTION. Datta, R. N. (University Coll. of Science and Tech., Calcutta). Indian J. Radio Space Phys.; 3: No. 4, 363-365(Dec 1974).

A critical examination of neutral gas motion in the E region of the ionosphere is made and it is observed that such a motion may induce anisotropy in the ionospheric irregularities of the E region. This is supported by some observational evidence obtained from the results reported elsewhere. (2 figs., 8 refs.) (auth)

20755 REDISTRIBUTION OF CHARGED PARTICLES IN THE IONOSPHERE AND FORMATION OF SPORADIC E LAYER. Ranade, N.; Singh, R. N. (Banaras Hindu Univ., India). Indian J. Radio Space Phys.; 3: No. 4, 366-369(Dec 1974).

The redistribution of charged particles in the lower ionosphere in the presence of wind shear has been studied. The transport properties of ions have been used to obtain a differential equation in N and Z. The differential equation is solved with the help of a conservation condition for total number of electrons in the wind shear region. The electron density profiles resulting from redistribution due to the neutral wind component U_x (E-W) and U_y (N-S) have been evaluated. The electron density profiles have been computed for assumed variance in the neutral wind profile. The computed results show the formation of very thin E_s layer. The results have been discussed in the light of experimental observations. (3 figs., 10 refs.) (auth)

20756 WAVE–PARTICLE INTERACTION IN MAGNETOPLASMA AROUND THE UPPER HYBRID RESONANCE. Gwal, A. K.; Nath, O.; Mishra, S. P.; Misra, K. D. (Banaras Hindu Univ., India). Indian J. Radio Space Phys.; 3: No. 4, 370-372 (Dec 1974).

With the help of equation of motion of electrons and Maxwell's field equations an expression for propagation constant has been derived and the propagation characteristics of the electromagnetic wave propagated perpendicular to the magnetic field have been studied. Using the expression for propagation constant, expressions for the attenuation and phase constants for the wave have been obtained. The variation of these constants with the normalized frequency parameter has been computed and plotted. The plots depict the nature of the wave particle interaction around the upper hybrid resonance. It is observed that such resonance is capable of playing an important role in the propagation of electromagnetic waves in the ionosphere as well as in the laboratory plasma. (3 figs., 8 refs.) (auth)

20757 ROLE OF BREMSSTRAHLUNG CROSS-SECTION ON THE GENERATION OF X-RAY PHOTONS IN THE LOWER IONOSPHERE. Rausaria, R. R.; Singhal, R. P.; Singh, R. N. (Banaras Hindu Univ., India). Indian J. Radio Space Phys.; 3: No. 4, 373-379(Dec 1974).

Various formulae for bremsstrahlung cross-sections have been reviewed and their suitability for the study of atmospheric bremsstrahlung has been discussed. Computations have been made using these formulae to study the angular dependence of the bremsstrahlung cross-section for a wide range of incident electron energy and emitted photon energy. It is shown that the bremsstrahlung cross-sections obtained by different methods differ from one another. Sample calculation of the angular dependence of the bremsstrahlung X-ray flux generated in the lower ionosphere has been made. The integrated X-ray flux is found to be larger than the result reported earlier. This value of the flux is likely to show better agreement with the measured bremsstrahlung flux. (2 figs., 14 refs.) (auth)

20758 CALCULATION OF AURORAL HISS WITH IMPROVED MODELS FOR GEOPLASMA AND MAGNETIC FIELD. Maeda, K. (National Aeronautics and Space Administration, Greenbelt, MD). Planet. Space Sci.; 23: No. 5, 843-865(May 1975).

Intensities of auroral hiss generated by the Cherenkov radiation process by electrons in the lower magnetosphere are calculated with respect to a realistic model of the Earth's magnetosphere. In this calculation, the magnetic field is expressed by the "Mead-Fairfield Model," and a static model of the ions-magnetospheric plasma distribution is constructed with data accumulated by recent satellites (Alouette-I, -II, ISIS-I, OGO-4, -6 and Explorer 22). The energy range of hiss producing electrons and the frequency range of the calculated VLF are 100 to 200 keV, and 2 to 200 kHz, respectively. Intensities with a maximum around 20 kHz, of the order of 10^{-14} W/m^2/Hz^1 at the ground seem to be ascribable to the incoherent Cherenkov emission from soft electrons with a differential energy spectrum E^{-2} having an intensity of the order of 10^2 cm^{-2}/sec/sr/eV at 100 eV. (auth)

20759 INFRASONIC WAVE GENERATION BY AURORA. Wilson, C. R. (Univ. of Alaska, College). J. Atmos. Terr. Phys.; 37: No. 6/7, 973-988(Jun 1975).

A comparison of the characteristics of auroral infrasonic waves (AIW) in the passband from 10 to 100 sec. period is given for trans-auroral zone stations. The morphology of 2 Hz auroral infrasound observed at Kiruna, Sweden is described. An important asymmetry in the generation of AIW bow waves is shown to be related to the morphology of the ionospheric E-region electric field during an auroral substorm. Auroral radar studies of AIW source arcs are presented. Incoherent scatter radar observations of electron density profiles of auroral arcs are used to describe the differences in arcs that do or do not produce AIW. An infinite line-current induction model of an auroral electrojet moving transverse to its axis above a conducting earth is used to determine the relationship of an AIW to the surface magnetic perturbation produced by the electrojet. The role of the auroral electrojet in AIW production is discussed. Theoretical work on the generation of AIWs is reviewed and evaluated. Lorentz force and Joule heat are discussed as probable source terms for the production of the acoustic energy within an auroral electrojet. The important unsolved problems in understanding auroral infrasound are outlined. (auth)

20760 IONIZATION-RECOMBINATION CYCLE OF THE D-REGION. Danilov, A. D. (Gidrometeorologicheskaya Sluzhba, Moscow). J. Atmos. Terr. Phys.; 37: No. 6/7, 885-894(Jun 1975).

It is shown that in the upper D-region, where negative ions may be neglected, the effective recombination coefficient in quadratic equation of electron balance is not kept constant at the fixed level, and is roughly proportional to electron concentration. This fact may be understood studying the positive ion composition variations (parameter $f^+ = [\text{Clust.}^+]/([NO^+] + [O_2^+])$. It is shown that f^+ is decreasing with [e] or q increase. The simplified scheme of charged particle transformation is able to explain this behavior of f^+, assuming that the effectiveness of "normal" ion to clustered ion transformation varies with conditions. In the negative ion transformation scheme, two types of ions are recognized. The scheme is able to provide a decrease of the effective recombination coefficient in the lower D-region during solar flares if the photo-detachment of "stable" ions is taken to be negligible. (auth)

20761 HYDROSTATIC MODEL OF THE OUTER IONOSPHERE AND METHOD OF DETERMINING MEAN ELECTRON DENSITY AND TEMPERATURE PROFILES WITH WHISTLERS. Al'pert, Ya. L.; Filgel, D. S. Cosmic Res.; 12: No. 6, 798-807(1974).

Translated from Kosm. Issled.; 12: No. 6, 880-891(1974).

For the description of the height dependence of the electron density N(z) of the outer ionosphere (z ≈ 1100-25,000 km), formulas are recommended that are derived on the basis of the hydrostatic model of the ionosphere taking into consideration the height dependence of the electron temperature T(z) given empirically. A comparison of the theoretical dependences with some experimental data shows good agreement. A method is proposed for determining the mean electron density and temperature profiles N(z) and T(z) in the outer ionosphere from the analysis of sonograms of whistlers $\omega_{exp}(\tau)$. Forty-one sonograms of whistlers recorded at Moscow and Riga for the average value of the masses M_0 along the wave trajectory $M_0 = M(H_\tau^+)$ and $M_0 = 4M(H_\tau^+)$ are analyzed. This makes it possible to obtain the mean dependences N(z) for the investigated conditions of the experiments. The computations of electron whistlers $\omega(\tau)$ give good agreement with $\omega_{exp}(\tau)$. (6 figs., 14 refs.) (auth)

20762 EFFECT OF γ-FLARES ON THE IONOSPHERE. Burgin, M. S. Cosmic Res.; 12: No. 6, 859-860(1974).

Translated from Kosm. Issled.; 12: No. 6, 949-950(1974).

The ionospheric electron density perturbation δn_e during the flare 72.4 of Vela catalog is computed. (GHT)

20763 LOW LATITUDE F-REGION ANOMALIES AND THE EQUATORIAL ELECTRIC FIELD. Rajaram, G.; Rastogi, R. G. (Physical Research Lab., Ahmedabad, India). Indian J. Radio Space Phys.; 3: No. 4, 323-331(Dec 1974).

A study is made of the profiles of the electron density distribution at the equator during days of strong and weak equatorial electric field. The diurnal and latitudinal variations of the F-region ionization at low-latitudes are shown to be closely associated with the east-west electric field over the magnetic equator. In extreme cases of reversal of the geomagnetic field H at the equator for a few hours around noon, the F_2 region Appleton anomaly itself is found to be reversed. A study of the electron density distributions made on such days shows larger ionization

at the equator than at a station at 30° dip which normally is an anomaly crest. Electron drift measurements at the equator show a westward electrojet at times of reversal of the geomagnetic field. The feature of a reversed F_2 anomaly is explained in terms of a downward E × B drift at the equator. (8 figs, 33 refs) (auth)

20764 GEOMAGNETIC STORM EFFECTS ON IONOSPHERIC DRIFTS AND THE EQUATORIAL E_s OVER THE MAGNETIC EQUATOR. Chandra, H.; Rastogi, R. G. (Physical Research Lab., Ahmedabad, India). Indian J. Radio Space Phys.; 3: No. 4, 332-336(Dec 1974).

Study of the ionospheric drifts at Thumba near the magnetic equator during the geomagnetic storms shows that there are daytime counter electrojets on several occasions, showing eastward electron drift and E_s-q disappearance. Such counter electrojet events are seen for a duration when the geomagnetic H value drops below the night level. This can be checked from the parameter [$H_{equator}$(at either Trivandrum or Kodaikanal) minus $H_{non\text{-}equator}$ (Alibag)] rather than from the simple H value or H minus D_{st}. The E_s-q is unaffected by the geomagnetic disturbances except for the brief periods of counter electrojet when it disappears. The mean midday f_0E^* on disturbed days is lower than on quiet days due to the more frequent disappearances of E_s-q during the geomagnetically active periods rather than the reduction of f_0E^* due to geomagnetic activity. (6 figs., 18 refs.) (auth)

20765 STUDY OF TWIN WHISTLERS AT THE LOW LATITUDE STATIONS GULMARG AND NAINI TAL. Singh, B.; Tantry, B. A. P. (Banaras Hindu Univ., India). Indian J. Radio Space Phys.; 3: No. 4, 341-348(Dec 1974).

Employing Haselgrove equations and a diffusive equilibrium model of ionosphere, ray-tracing computations have been carried out to explain the propagation characteristics of two types of twin whistlers recorded at the low latitude ground stations Gulmarg (geomag. lat., 24°10′N) and Naini Tal (geomag. lat., 19°1′N). The results show that both the types of twin whistlers, having almost constant time-delay difference between their parallel traces, are caused by electromagnetic waves radiated from a return stroke of lightning discharge which penetrated the ionosphere at two different points, propagated in the pro-longitudinal whistler mode of propagation in the magnetosphere and arrived at the observing stations as bunches of twin whistler waves producing two close traces in the whistler sonograms. The slightly different characteristics of the two types of twin whistlers are attributed to the difference in their pro-longitudinal mode of propagation in the magnetosphere. (10 figs., 22 refs.) (auth)

20766 IONOSPHERIC SPREAD-F AT HUANCAYO, SUNSPOT ACTIVITY AND GEOMAGNETIC ACTIVITY. Bowman, G. G. (Queenland Univ., St. Lucia, Australia). Planet. Space Sci.; 23: No. 5, 899-903(May 1975).

A superposed-epoch method is used to investigate the occurrence of spread-F at Huancayo relative to days of high sunspot activity and also relative to days of high geomagnetic activity. A good correlation is found between days of high A_p index and high spread-F occurrence for a pre-sunrise interval of a few hours. When 3-hourly K_p indices are used they show a peak value approximately 6 hr prior to an above-average occurrence of spread-F. It is suggested that this pre-sunrise spread-F is associated with ionospheric height rises which are produced by travelling disturbances, initiated in polar regions at times of high geomagnetic activity. (auth)

20767 DISTANT MODULATION OF ELECTRON INTENSITY DURING THE EXPANSION PHASE OF AN AURORAL SUBSTORM. Bryant, D. A.; Smith, M. J.; Courtier, G. M. (Science Research Council, Slough, Eng.). Planet. Space Sci.; 23: No. 5, 867-878 (May 1975).

Pulses in electron intensity, occurring during the expansion phase of an auroral substorm, were studied using a Skylark sounding rocket launched from Kiruna, Sweden at 2226:50 UT on 2 March 1972. The pulses were typically of 5 s duration and occurred sporadically with a typical interval of 1[illegible] s. The rocket carried main and ejected payloads, and the pulses, occurring simultaneously at both, are found to be temporal rather than spatial in origin. Pitch-angle distributions changed little during a pulse, remaining slightly peaked towards larger pitch-angles. Precipitation is thought to be caused by pitch-angle diffusion under conditions where scattering angles are large compared with the opening angle of the loss cone. Enhanced scattering and variations in the temperature of the source plasma are both considered as possible causes of the pulse-like modulation. (auth)

20768 D-REGION IN DISTURBED CONDITIONS, INCLUDING FLARES AND ENERGETIC PARTICLES. Mitra, A. P. (National Physical Lab., New Delhi). J. Atmos. Terr. Phys.; 37: No. 6/7, 895-913(Jun 1975).

A unified picture of the chemistry of the normal and the disturbed D-region is presented. Under disturbed conditions are included: (a) solar flares, (b) PCAs and (c) solar eclipses. The connecting thread is the six ion model of Mitra and Rowe (J. Atmos. Terr. Phys.; 34:795 (1972)), with appropriate modifications where necessary. Several areas of identity in the observational results of flares and PCAs are reviewed. These include: the dominance of $q(O_2^+)$ over $q(NO^+)$ due to X-rays in the first case and energetic particles in the second; drastic decrease in the effective loss coefficient during both flares and PCAs; disappearance of water cluster ions down to 73 km during day and 78 km at night during PCAs; the reversion of negative ions to their basic forms (O^- and O_3^-) during PCAs. For solar eclipses, the effects are essentially a mirror image of these due to flares and PCAs. (auth)

20769 ENERGY DEPOSITION IN THE THERMOSPHERE CAUSED BY THE SOLAR WIND. Cole, K. D. (La Trobe Univ., Bundoora, Australia). J. Atmos. Terr. Phys.; 37: No. 6/7, 939-949(Jun 1975).

The subject of joule dissipation of ionospheric currents and movement of the thermosphere by electric fields is briefly reviewed and the depositions of energy into the thermosphere by charged particles and electric fields are compared. Dissipation of electric fields is a major source of energy for the thermosphere. The injection of energy into the atmosphere during geomagnetic storms is negligible compared to what is needed to modify the weather except in the thermosphere and perhaps a few scale heights below it. A simple explanation of the correlation of magnetic disturbances and weather in the lower atmosphere, propounded earlier by the author, is included here. (auth)

Effects of Nuclear Detonations

20770 PERTURBATION OF MAGNETIC FIELDS BY NON-STATIONARY SOURCES OF GAMMA QUANTA. Vilenskaya, G. G.; Medvedev, Yu. A.; Fedorovich, G. V.; Stepanov, B. M. Zh. Prikl. Mekh. Tekh. Fiz.; No. 2, 141-146(1975). (In Russian).

On the basis of the results of a numerical integration of a system of Maxwell equations, describing the spatial-time variations of the field, the perturbations of a magnetic field close to a non-stationary γ source was studied. The radioemission connected with this perturbation was also examined. (tr-auth)

20771 F-LAYER EFFECTS CAUSED BY THE CHINESE NUCLEAR EXPLOSION OF 14 OCTOBER 1970. Venkatachari, R.; Saha, A. K.; Sachdeva, V. P. (National Physical Lab., New Delhi). Indian J. Radio Space Phys.; 3: No. 4, 353-355(Dec 1974).

A large increase in f0F2 was observed at Delhi (going up to 21.9 MHz) following the Chinese nuclear explosion on 14 October 1970. True height analysis of ionograms at 5-min intervals reveals wavelike disturbances continuing for a few hours. The delay in the onset of the disturbance was too small to attribute them to internal atmospheric gravity wave type of propagation. (4 figs.) (auth)

Magnetospheric Phenomena

Refer also to abstracts 20568, 20737, 20764, and 20765.

20772 (LA-UR-75-791) RECENT OBSERVATIONS RELATING TO THE DYNAMICS AND ORIGIN OF THE MAGNETOTAIL PLASMA SHEET. Hones, E. W. Jr. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-eng-36. 28p. (CONF-750461-1). Dep. NTIS $4.50.

From the Nobel symposium on the physics of the hot plasma in the magnetosphere; Kiruna, Sweden (2 Apr 1975).

This paper reviews the substorm behavior of the plasma sheet and the evidence that a substorm expansive phase onset signals the sudden formation of a magnetic neutral line across a near region of the magnetotail. The neutral line forms at distances less than approximately 18 R/sub E/ in moderate to intense substorms, but at distances greater than approximately 30 R/sub E/ in weak substorms, or substorms detected only at high latitudes (on the contracted auroral oval). Several types of observations are presented as evidence that solar wind plasma enters the plasma sheet via convection along the cleft, through the magnetotail surface layer, through the magnetotail lobes and finally earthward from a magnetotail neutral line. These observations were made, however, during periods of southward interplanetary magnetic field; possibly this is a less effectual route for plasma entry to the plasma sheet when the IMF is northward. (auth)

20773 (TRITA-EPP-74-25) MECHANISM FOR DRIVING THE GROSS BIRKELAND CURRENT CONFIGURATION IN THE

AURORAL OVAL. Rostoker, G.; Bostroem, R. (Kungliga Tekniska Hoegskolan, Stockholm (Sweden). Institutionen foer Plasmafysik). Dec 1974. 34p. Dep. NTIS (US Sales Only) $4.75.

Birkeland (field-aligned) sheet currents flowing into and out of the auroral oval as reported by Zmuda and Armstrong (1974) are integrally associated with convective motion of plasma in the magnetotail. It is demonstrated that these currents can be driven by energy supplied by the braking of this convective motion of the plasma sheet particles as they drift towards the flanks of the magnetosphere. In the ionosphere the sheet currents close as Pederson currents resulting in power being dissipated, while far from the earth the closure currents, which provide the braking force for the plasma, flow in the plasma sheet approximately normal to the neutral sheet out to radial distances of about 80 R_E. During periods of moderate magnetospheric activity, the Birkeland currents result in a rate of dissipation of convective energy of the order of 10 GW. (auth)

20774 METEOROLOGY AND EXTRATERRESTRIAL PHYSICS. Spring Conference of the German Society of Physics, Berlin, Germany, March 3–7, 1975. Verhandlungen der Deutschen Physikalischen Gesellschaft, No. 2. Weinheim, Ger.; Physik Verlag GmbH (1975). 63p. (In German and English). (CONF-750340–(Absts.)).

Abstracts are compiled of the 44 papers presented on meteorology and of the 87 papers on extraterrestrial physics. (JSR)

20775 VARIATIONS IN POSITION OF MAGNETOPAUSE FROM DATA OF CHARGED PARTICLE TRAPS ON PROGNOZ AND PROGNOZ-2 SATELLITES. Gringauz, K. I.; Zastenker, G. N.; Khokhlov, M. Z. Cosmic Res.; 12: No. 6, 815-818(1974).

Translated from Kosm. Issled.; 12: No. 6, 899-902(1974).

The position of the magnetopause in the daytime sector in April-October, 1972 is examined. The position of the magnetopause in 1972 is closer to its position near the solar activity minimum (IMP 1, 1964) than to the position in the year of maximum activity (Heos 1, 1969). Despite the considerable scatter of the points a rather clear dependence is detected: a decrease in the dimensions of the magnetosphere with an increase in the level of geomagnetic activity. (4 figs., 22 refs.) (auth)

20776 SOME PROPERTIES OF THE CURRENT SHEET IN THE GEOMAGNETIC TAIL. Eastwood, J. W. (Univ. of Reading, Eng.). Planet. Space Sci.; 23: No. 1, 1-14(Jan 1975).

The influence of noise and the finite length and width of the tail on the behavior of the current sheet is discussed. The presence of a weak magnetic field linking through the current sheet leads to plasma containment and counterstreaming, with the consequence that both the plasma temperature and density are increased in the vicinity of the current sheet. The effect of these changes on the relationship between steady bulk parameters is discussed. The finite length of the tail significantly modifies the equilibrium situation in the near Earth tail, for streams mirroring at the Earthwards end of field lines lead to a reduction of merging. The finite width of the tail restricts the region of reduced merging rate to a triangular shaped area extending from the dusk magnetopause into the tail. The finite tail width is also important in the more distant tail, where magnetosheath particles which penetrate the magnetopause ends of the current sheet may become major current carriers. It is shown that the above factors, together with a non-adiabatic current sheet, are important to the understanding of the temporal behavior of the tail. (auth)

20777 SOLAR SITUATION PRECEDING THE GENERATION OF THE GEOMAGNETIC STORM OF JUNE 17–20, 1973. Bednarova-Novakova, B. (Geophysical Inst., Prague). Stud. Geophys. Geod.; 19: 191-197(1975).

A photograph of the space laboratory SKYLAB, taken on June 10, 1973, was used to analyze the causes of the generation of the geomagnetic storm which occured after the CMP of a region, related to an eastern coronal stream. It was found that assumptions about the existence of a coronal stream above the prominences, distributed along the meridian, as well as the densification of the formation above unstable effects, were proved. The agreement between reality and forecasts of geomagnetic activity constitutes further proof thereof. It was also found that the coronal formation lasted over several rotations. (2 figs.) (auth)

20778 SOLAR WIND-MAGNETOSPHERE DYNAMO AND THE MAGNETOSPHERIC SUBSTORM. Akasofu, S. I. (Univ. of Alaska, College). Planet. Space Sci.; 23: No. 5, 817-823(May 1975).

In a quiet condition, the solar wind kinetic energy is converted into electrical energy. A small part of this energy is dissipated as heat energy in the polar ionosphere. At least three types of magnetospheric disturbances which are not associated with an increase of the heat production are identified and named reversible disturbances, while the magnetospheric substorm is an irreversible disturbance which is associated with a large increase of the heat production. The magnetosphere appears to have an inherent internal instability by which a large amount of heat energy is sporadically produced in the polar upper atmosphere at the expense of the magnetic energy in the magnetotail. A positive feed-back process may be responsible for the growth of the instability and for the expansive phase, while the recovery phase sets in when some process begins to suppress the positive feed-back process. (auth)

20779 ACCELERATION OF CHARGED PARTICLES IN MAGNETOSPHERIC NEUTRAL PLASMA SHEET. Khosa, P. N.; Rausaria, R. R.; Singh, R. N. (Banaras Hindu Univ., India). Indian J. Radio Space Phys.; 3: No. 4, 407-415(Dec 1974).

The reconnection of magnetic field lines in the neutral plasma sheet has been studied in the light of momentum conservation and charge neutrality. The effect of field variations and plasma conductivity on the charged particle dynamics has been studied. It is found that the charged particles emerging out of the neutral plasma sheet are energized. It is argued that the reconnection process would make the plasma sheet unstable. The onset of likely instabilities in the neutral plasma sheet and their geophysical implication has been briefly outlined. (10 figs., 19 refs.) (auth)

PHYSICS (ATOMIC AND MOLECULAR)

Beams and Their Reactions

Refer also to abstracts 20812, 20813, 20827, 21031, 21341, 21358, 21359, and 21362.

20780 (INIS-mf-1766, pp 13-31) HYPERTHERMAL BEAMS SPUTTERED FROM ALKALIHALIDE SURFACES. Chapter 1. Koennen, G. P.; Grosser, J.; Haring, H.; Vries, A. E. de; Kistemaker, J. 18 Sep 1974.

In energy distributions of sputtered neutrals and electron transfer and reactive ionization in atom-molecule collisions. (Amsterdam Univ. (Netherlands)).

Velocity selected beams of atoms and molecules have been produced by sputtering from various alkali halide surfaces under 6-keV Ar^+ ion bombardment. The mass spectrum and the velocity distribution of these particles have been analyzed in the range from 0–13000 m/s. In the low-velocity part of the spectrum monatomic particles as well as polyatomic ones have been found. For velocities larger than 3000 m/s the number of sputtered molecules is very small compared to the number of atoms. In addition to typical sputtering velocity distributions, thermal distributions are also found, due to vaporization of the less effectively sputtered atoms from the crystals. Above a few eV the energy distribution of a given alkali or halogen atom is independent of the target from which it is sputtered. There are indications that some sputtered atoms and molecules are formed in long-lived excited states. (auth)

20781 (INIS-mf-1766, pp 32-51) ON THE ENERGY DISTRIBUTION OF SPUTTERED CLUSTERS. Chapter 2. Koennen, G. P.; Tip, A.; Vries, A. E. de. 18 Sep 1974.

In energy distributions of sputtered neutrals and electron transfer and reactive ionization in atom-molecule collisions. (Amsterdam Univ. (Netherlands)).

A theoretical expression is obtained for the energy distribution of sputtered clusters from crystal surfaces. The derivation is based on a model where the atoms which constitute a cluster, are sputtered independently from the crystal according to their respective single particle energy distribution functions. Simultaneously sputtered atoms are then supposed to form a cluster if the sum of their initial relative kinetic energy and potential energy is less than the lowest dissociation energy of the cluster. A comparison with experimental results for W_k ($k \leq 3$), K_2 and KI sputtered from polycrystalline W, K and KI surfaces, respectively, shows good agreement. For the ionic crystal KI, evidence is obtained that sputtering of K and I atoms which are not closest neighbors gives an important contribution to dimer formation. The role of the binding energy E_b of the particles with respect to the surface is discussed. (INIS)

20782 (INIS-mf-1766, pp 52-58) NEGATIVE SURFACE IONIZATION OF HYPERTHERMAL HALOGEN ATOMS. Chapter 3. Koennen, G. P.; Grosser, J.; Haring, A.; Vries, A. E. de. 18 Sep 1974.

In energy distributions of sputtered neutrals and electron transfer and reactive ionization in atom-molecule collisions. (Amsterdam Univ. (Netherlands)).

Negative surface ionization of hyperthermal halogen atoms was studied as a function of their kinetic energy on thoriated tungsten and on niobium wires. The transition from a thermal equilibrium process to direct reflection causes the ionization to increase drastically above thermal energies: efficiencies up to 40% were found for 30 eV Cl atoms impinging on thoriated tungsten. (INIS)

20783 (JINR-R-14-7754) HEAVY ION BEAM APPLICATION IN PRACTICE. Flerov, G. N.; Barashenkov, V. S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1974. 53p. (In Russian). INIS.

39 refs.; 18 figs.; 1 table; submitted to Soviet Physics - Uspekhi.

The different uses of a heavy-ion beam in various areas of science and technology were examined. These include use in the solution of problems in solid state physics, for metallurgy, biology, and preparation of unique nuclear filters. (tr-auth)

20784 (NP-20480(P8), pp 104-105) SECONDARY ELECTRON EMISSION FROM Al AND Ni BY FAST-PROTON BOMBARDMENT. Koyama, A.; Yagi, E.; Sakairi, H. Dec 1974.

In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

20785 (NP-20510) DESIGN AND FABRICATION OF A CONTAINER EXPOSED TO HIGH VACUUM USED IN AN ION POLARIZATION SYSTEM. Cano, J. M. A. O. (Instituto Politecnico Nacional, Mexico City. Escuela Superior de Ingenieria Mecanica y Electrica). 1975. 142p. (In Spanish). Dep. NTIS (US Sales Only) $10.25.

Thesis.

The basic concepts in high-vacuum technology and the characteristics of high vacuum systems and their components are discussed. The design, operation, and application of a polarized ion source are described. The design and selection of materials for the housing of a Cs capsule for a polarized ion source is analyzed in some detail. An economic study is made of the construction of the container from materials available in Mexico. (JSR)

20786 (ORNL-5025, pp 147-148) RADIATIVE ELECTRON CAPTURE. Biggerstaff, J. A.; Appleton, B. R.; Datz, S.; Moak, C. D.; Neelavathi, V. N.; Noggle, T. S.; Ritchie, R. H.; VerBeek, H. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

Some data are presented for radiative electron capture by fast moving ions. The radiative electron capture spectrum is shown for O^{8+} in Ag, along with the energy dependence of the capture cross-section. A discrepancy between earlier data, theoretical prediction, and the present data is pointed out. (3 figs) (GMT)

20787 (ORNL-5025, pp 148-149) STOPPING POWER OF CHANNELED IODINE IONS AT LOW VELOCITIES. Biggerstaff, J. A.; Appleton, B. R.; Brown, M. D.; Datz, S.; Moak, C. D.; Noggle, T. S.; VerBeek, H. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

The results of some recent measurements of the specific energy loss of 0.6- to 60.0-MeV iodine ions in the (111) planar channel of a silver crystal are shown. (1 fig) (GHT)

20788 (SAND-75-5241) SIMULTANEOUS INTEGRAL MEASUREMENT OF ELECTRON ENERGY AND CHARGE ALBEDOES. Lockwood, G. J.; Miller, G. H.; Halbleib, J. A. Sr. (Sandia Labs., Albuquerque, N. Mex. (USA)). [nd]. 8p. (CONF-750703-7). Dep. NTIS $4.00.

From IEEE annual conference on nuclear and space radiation effects; Arcata, California, USA (14 Jul 1975).

Results of a series of experiments in which backscattered energy has been determined from precise energy deposition measurements using an improved technique are presented. The fraction of the energy backscattered for electrons incident on Be, Ti, Mo, and Ta is determined as a function of energy and angle of incidence. The improved technique for the absolute measurement of energy deposition using calorimeters involves square-wave (on-off) modulation of the beam. Uncertainties in the measured backscattered energy are 1 to 6 percent, except for Be at normal incidence where they must agree by definition. Experiment and theory agree quite well for Mo and Be at 60^0. The measured data for Ta and Ti are clearly higher than the calculated results, which is not completely understood. (BJG)

20789 OXYGEN-DEPENDENT PHOTON EMISSION FROM Ne^+-BOMBARDED Mg. Kerkdijk, C. B. W.; Kelly, R. (Stichting voor Fundamenteel Onderzoek der Materie, Amsterdam). pp 71-101 of Bombardment-Induced Photon Emission from Solids. Kerkdijk, C. B. W. (ed.). Amsterdam; Stichting voor Fundamenteel Onderzoek der Materie (28 May 1975).

The optical spectrum observed when solid Mg is bombarded with 10-keV Ne^+ consists dominantly of spectral lines from Mg and Mg^+, together with weaker lines from Ne, Ne^+, O^+, and H. Molecular emission, attributed to de-excitation of MgO and MgH, is also observed, though with much lower intensity. Some spectral lines are enhanced by oxygen at or in the surface, others are unaffected by oxygen, while some decrease in intensity due to oxygen. Out of 21 lines for which information is available, 16 are shown to have an oxygen dependence which can be understood qualitatively in terms of a model of resonant electron transfer combined with oxygen-induced changes in the band structure. The topography of the visibly changed surface of the Mg target after several hours of bombardment is investigated with a scanning electron microscope. (auth)

20790 1-17 KeV POSITIVE-ION-INDUCED ELECTRON EJECTION FROM TUNGSTEN, MOLYBDENUM, AND VANADIUM. Cook, N.; Burtt, R. B. (King's Coll., London). J. Phys., D (London); 8: No. 7, 800-811(11 May 1975).

Measurements have been made of the secondary electron currents resulting from positive ion bombardment of clean (100) crystal targets of tungsten, molybdenum and vanadium, as well

as polycrystalline tungsten, by a range of ions with incident energies between 1 and 17 keV. Data from a relatively large number of bombarding ion species give support to Parilis and Kishinevskii's theory of kinetic electron ejection from metals (Sov. Phys. Solid St.; 3: 885-91 (1960)) and indicate the isotopic dependence of kinetic electron ejection, and that of the ejection coefficient and threshold velocities, on ion and target atom numbers. (auth)

20791 KINETIC ELECTRON EJECTION BY SCATTERED NEUTRALIZED POSITIVE IONS. Cook, N.; Burtt, R. B. (King's Coll., London). J. Phys., D (London); 8: No. 7, 812-819(11 May 1975).

A crude energy analysis of positive secondary currents (measured on the collecting surfaces) from clean single-crystal targets of tungsten, molybdenum and vanadium, as well as polycrystalline tungsten, indicates that significant proportions of the currents measured result not only from sputtered target ions but also from kinetic electron ejection from the collecting surfaces by scattered incident particles. Some correlation has been achieved with kinetic ejection thresholds calculated according to simple hard-sphere collision theory. (auth)

20792 MOLECULAR BEAMS FROM FREE JET EXPANSIONS OF MOLECULES AND MIXED GASES. Buck, U.; Pauly, H.; Pust, D.; Schleusener, J. (Max-Planck-Institut fuer Stroemungsforschung, Goettingen, Ger.). pp C.10.1-C.10.9 of Rarefied Gas Dynamics. Vol. II. Becker, M. (ed.). Linder Hoehe, Ger.; DFVLR-Press (1974).

From 9th international symposium on rarefied gas dynamics; Gottingen, F. R. Germany (15 Jul 1974). See CONF-740743-P2.

Studies of molecular beams of Ar, N_2, and mixtures of 1% Xe in H_2 are presented. The work was carried out as a test of theoretical predictions of intensity and velocity distributions of beams from free jet expansions. Results for two different chambers are shown. (5 fig, 17 refs.) (GHT)

20793 HIGH INTENSITY SUPERSONIC MOLECULAR BEAMS WITH EXTREMELY NARROW ENERGY SPREADS IN THE 0 TO 37 eV RANGE. Campargue, R.; Lebehot, A. (CEN de Saclay, Gif-sur-Yvette, France). pp C.11.1-C.11.12 of Rarefied Gas Dynamics. Vol. II. Becker, M. (ed.). Linder Hoehe, Ger.; DFVLR-Press (1974).

From 9th international symposium on rarefied gas dynamics; Gottingen, F. R. Germany (15 Jul 1974). See CONF-740743-P2.

The disturbance due to the invasion of the free jet by background molecules is eliminated by increasing the stagnation pressure P_0 instead of decreasing the pressure P_1 in the expansion chamber, as is usually done. This original solution allows the construction of compact nozzle beam generators with $P_1 \simeq 10^{-1}$ torr and very low nozzle Knudsen numbers able to produce very high terminal Mach numbers. Effectively, with an optimized design of the nozzle-skimmer system operating in these conditions, axial terminal Mach numbers higher than 100 are achieved for He beams at room temperature. Very narrow energy spreads are also obtained with a heated nozzle (300 K-3000 K) from pure gas beams and seeded beams, in the range from thermal to intermediate energies (e.g., 37 eV for Xe accelerated by H_2). (9 figs., 20 refs.) (auth)

20794 THEORY OF COLLISION BETWEEN AN ATOM AND A SIMPLE CUBIC HARMONIC LATTICE. Comparison with Some Recent Experimental Results. Armand, G.; Lapujoulade, J. (CEN de Saclay, Gif-sur-Yvette, France). pp E.4.1-E.4.11 of Rarefied Gas Dynamics. Vol. II. Becker, M. (ed.). Linder Hoehe, Ger.; DFVLR-Press (1974).

From 9th international symposium on rarefied gas dynamics; Gottingen, F. R. Germany (15 Jul 1974). See CONF-740743-P2.

A theoretical calculation of neutral atom collision on a simple cubic lattice has been recently achieved, taking into account the lattice temperature. All the interaction between atoms are of harmonic type. The lobe of reflection is computed assuming conservation of incident tangential momentum. The aim is here to compare calculated and experimental results. In case of helium and neon beams colliding on silver (111), with different lattice temperature, incident angle and incident particle energy, one obtains a good agreement as far as the inelastic part of the lobe is concerned. The elastic part of the lobe is not theoretically obtained with helium beam of very low incident kinetic energy. So the theory suggests the existence of a localized surface mode due to the helium or neon-lattice interaction, the frequency of which is respectively of the order of 3 and 1.6 times the maximum frequency of the bulk. (8 figs., 12 refs.) (auth)

20795 SIMPLE MODEL WHICH CORRECTLY PREDICTS THE SCATTERING OF HEAVY PARTICLES FROM A WELL DEFINED SURFACE AT TRANSLATIONAL ENERGIES BETWEEN 2 AND 20 eV. Hulpke, E. (Max-Planck-Institut fuer Stroemungsforschung, Goettingen, Ger.). pp E.5.1-E.5.10 of Rarefied Gas Dynamics. Vol. II. Becker, M. (ed.). Linder Hoehe, Ger.; DFVLR-Press (1974).

From 9th international symposium on rarefied gas dynamics; Gottingen, F. R. Germany (15 Jul 1974). See CONF-740743-P2.

The scattering of Li^{2+} ions from W(110) and Si(111) surfaces has been investigated at beam energies between 2 and 20 eV. Energy distributions of the scattered ions have been measured with extremely high energy resolution (1%) for different scattering angles and different states of surface contamination. It is shown that collisions between gas atoms and a solid surface at energies in the range of a few eV can be understood in terms of binary collisions with isolated surface atoms if the far reaching attractive interaction potential is taken into account. With only very coarse assumptions as to the form of the interaction potential this model is capable of predicting the mean final energy of the scattered particles as well as all the trends in the width of the energy spectra. (7 figs) (GHT)

20796 SURFACE-SCATTERING AND DIFFRACTION EXPERIMENTS WITH MONOENERGETIC BEAMS OF ATOMIC HYDROGEN AND DEUTERIUM. Hoinkes, H.; Finzel, H.; Frank, H.; Nahr, H.; Wilsch, H. (Univ., Erlangen-Nuernberg, Ger.). pp E.7.1-E 7.9 of Rarefied Gas Dynamics. Vol. II. Becker, M. (ed.). Linder Hoehe, Ger.; DFVLR-Press (1974).

From 9th international symposium on rarefied gas dynamics; Gottingen, F. R. Germany (15 Jul 1974). See CONF-740743-P2.

Thermal and velocity selected beams of atomic hydrogen and atomic deuterium are scattered from the (001) cleavage plane of NaF. Diffracted beams are observed and the intensity in the (0,0) diffraction peak (specular beam) is investigated in detail, especially its dependence on surface temperature and angle of incidence. An effective surface Debye temperature of $\theta_{D\perp} = (400 \pm 40)$ K is extracted from these measurements. (5 figs, 17 refs) (auth)

20797 TRANSITION BETWEEN ATOM-SURFACE SCATTERING REGIMES. Liu, S. M.; Rodgers, W. E.; Knuth, E. L. (Univ. of California, Los Angeles). pp E.8.1-E.8.10 of Rarefied Gas Dynamics. Vol. II. Becker, M. (ed.). Linder Hoehe, Ger.; DFVLR-Press (1974).

From 9th international symposium on rarefied gas dynamics; Gottingen, F. R. Germany (15 Jul 1974). See CONF-740743-P2.

The transition between thermal and structural scattering of atomic beams from relatively clean (111) silver surfaces has been studied experimentally. Spatial-scattering-distribution parameters, namely the width at one-half peak amplitude and the peak position, were obtained for 0.06- to 15-eV argon and 0.06- to 8-eV neon beams. The trend of the present results agrees qualitatively with Oman's predictions and with previous experimental data. It was found that the half-width is a much better correlation parameter for the transition between the two scattering regimes than is the peak position. The incident beam energy at the transition between the two scattering regimes can be correlated in terms of incident energy (E_i^t) and incidence angle (θ_i) by $E_i^t \cos^2\theta_i$, i.e., by a constant value of the energy associated with the normal component of the incident velocity for a given species. For scattering from a surface at 300°C, the critical transition energy is about 0.72 eV for an argon beam and about 0.26 eV for a neon beam. (6 figs, 11 refs) (auth)

20798 INVESTIGATIONS OF THE REACTIONS OF O_2, N_2O, AND H_2O ON Ge, Si, AND GRAPHITE SURFACES BY MEANS OF DYNAMICAL MOLECULAR BEAMS. Schuetze, C.; Schuegerl, K. (Univ., Hanover). pp E.11.1-E.11.9 of Rarefied Gas Dynamics. Vol. II. Becker, M. (ed.). Linder Hoehe, Ger.; DFVLR-Press (1974).

From 9th international symposium on rarefied gas dynamics; Gottingen, F. R. Germany (15 Jul 1974). See CONF-740743-P2.

Dynamical O_2, N_2O- and H_2O-molecular beams were directed to the surfaces of single crystals of germanium and silicon with the orientation (111) and to graphite targets. The momentum due to the beam molecules, the accommodation coefficients of normal momentum and the reaction probabilities were evaluated as function of the target temperature. (5 figs) (auth)

20799 ANGULAR DISTRIBUTIONS OF 40, 80, AND 160 MeV POSITRONS SCATTERED BY ALUMINUM FOILS. Vorob'ev, S. A.; Kryuchkov, Yu. Yu.; Timoshnikov, Yu. A. Sov. At. Energy (Engl. Transl.); 37: No. 2, 868-869(Aug 1974).

Translated from At. Energ.; 37: No. 2, 165-166(Aug 1974).

Measurements were made of positron scattering by 100μ and 200μ aluminum foils. The results show that the process of multiple scattering of high-energy positrons is described quite well by the first Born approximation, and for engineering calculations it is not necessary to use a more exact theory which accounts for the sign of the charge of the particles. 1 fig, 6 refs (GHT)

20800 STUDY ON THE BEAM QUALITY OF POLARIZED ION SOURCES. Hamdi, K. Karlsruhe, Ger.; Univ. Karlsruhe (1973). 104p. (In German). INIS.

Thesis.

Emittance and brightness of polarized ionic beams produced by Lamb shift source are measured and compared with atomic beam sources. It is shown that the beam quality of atomic beam sources can be improved using hf-ion source plasma and not electron impact for ionization. (GE)

20801 A NEW METHOD TO PRODUCE TRANSVERSAL POLARIZED DEUTERON BEAMS BY LAMB SHIFT SOURCE. Bechthold, V. Karlsruhe, Ger.; Univ. Karlsruhe (1973). 56p. (In German). INIS.

Thesis.

A transverse polarized deuteron beam is produced by adiabatic spin rotation of a neutral metastable atomic beam and ionization in a transversal magnetic field for a Lamb shift source. This method is independent for positive and negative transverse polarized deuteron beams. Positive ions are produced by iodine charge exchange. (GE)

20802 RAREFIED GAS DYNAMICS. Volume I. Proceedings of the Ninth International Symposium, Goettingen, Germany, July 15–20, 1974. Becker, M.; Fiebig, M. (Eds.). Linder Hoehè, Ger.; DFVLR-Press (1974). vp. (CONF-740743-P1).

The papers provide a comprehensive coverage of recent progress in the various areas of rarefied gas dynamics. The following topics are treated: Analytical and Numerical Methods including Kinetic Theory, Boltzmann Equation, Couette Flows and Knudsen Layers; Physics of Flows of Free Jets and Wakes, Free Jet Background Interaction, Relaxation Phenomena, Shock Structure and Reaction Kinetics; Experimental Techniques and Molecular Beams; Flows Around Bodies and Internal Flows over Flat Plates, Cones, Spheres, Cylinders, Three Dimensional Bodies, Flows through Ducts and Channels, Gas Surface Interaction, Phenomenology, Accommodation Coefficients and Reactive Scattering; Theoretical and Experimental Research on Condensation in Flows and on Surfaces. Three articles are abstracted separately. (auth)

For abstracts of individual papers see: 19854, 20568, and 20857.

20803 SELF CROSSED-BEAM METHOD FOR INVESTIGATION OF ION–ION COLLISIONS. Fukuzawa, F. (Kyoto Univ. (Japan). Faculty of Engineering). Bull. Inst. Chem. Res., Kyoto Univ.; 52: No. 1, 40-46(Jul 1974).

A new method of self crossed-beam technique is proposed for investigation of ion-ion collision at moderate energies. Background scatterings from residual gas molecules are shown to be discriminated by use of kinematics relations. Collision yields are expected to be practically sufficient under ordinary experimental conditions. (auth)

20804 MOLECULAR BEAM INVESTIGATIONS OF ADSORPTION. Kusunoki, I. (Tohoku Univ., Sendai (Japan). Research Inst. for Scientific Measurements); Tomoda, S. Oyo Butsuri; 43: No. 9. 893-908(Sep 1974). (In Japanese).

Molecular beam investigations throw light to the dynamical character of adsorption on surfaces. In a collision between an atom (or molecule) and a surface the processes such as scattering (elastic, inelastic) and adsorption (perfect, imperfect) are possible. In this article a brief review is given on the recent development in the study of molecular beam scattering from solid surfaces. Recent studies of adsorption using metallic beams are also reviewed. The residence time on surfaces and the sticking coefficient is discussed from our point of view. A rate theory based on BET model is developed to interpret some sticking coefficient curves given in recent molecular beam experiments. (auth)

20805 A BACK-DIFFUSION TYPE SOURCE OF MONO-ENERGETIC IONS. Honzawa, T. (Utsunomiya Univ. (Japan). Faculty of Engineering). J. Phys. Soc. Jap.; 36: No. 6, 1674-1678(Jun 1974).

The results of our experimental study on a back-diffusion type ion source, which can be operated in any kind of gas at a pressure from 10^{-6} to 10^{-3} Torr, are described. The source produces mono-energetic ions with a controllable kinetic energy from a few tens to several hundreds eV and density up to several times 10^{7} cm^{-3}. The monoenergetic ions are neutralized by thermal electrons emitted from cathodes and hardly diverge during their run. They are available for the calibration of energy analyzers, experiments on collision processes of ions with atoms and so forth. (auth)

20806 MULTIPLE SCATTERING OF NITROGEN IONS ON METAL FOILS. Sakisaka, M. (Kyoto Univ. (Japan). Faculty of Engineering); Takasaki, M.; Yamazaki, T. Bull. Inst. Chem. Res., Kyoto Univ.; 52: No. 1, 12-18(Jul 1974).

Multiple scattering of 4 MeV nitrogen ions on aluminium, copper, silver, and gold foils were experimentally studied. The observed angular distributions of scattered ions were compared with Meyer's theory and a fairly good agreement was found. (auth)

Atomic and Molecular Properties

Refer also to abstracts 20225, 20844, and 20850.

20807 (ANL-8153, pp 150-160) THEORETICAL CHEMISTRY. Jan 1975.

In Chemistry Division annual report, July 1973--June 1974. (Argonne National Lab., Ill. (USA)).

Work in theoretical chemistry was organized under the following topics: scattering theory and dynamics (elastic scattering of the rare gas hydrides, inelastic scattering in $Li + H_2$, statistical theory for bimolecular collisions, model study of dissociative scattering, comparing study of elastic scattering computational methods), studies of atmospheric diatomic and triatomic species, structure and spectra of diatomic molecules, the evaluation of van der Waals forces, potential energy surfaces and structure and dynamics, calculation of molecular polarizabilities, and development of theoretical techniques and computing systems. Spectroscopic parameters are tabulated for NO_2, N_2O, H_2O^+, VH, and NH. Self-consistent-field wave functions were computed for He_2 in two-center and three-center bases. Rare gas hydride intermolecular potentials are shown. (9 figures, 14 tables) (RWR)

20808 (COO-2130-163, pp 329-351)) METASTABLE ATOMIC STATES OF HEAVY IONS. I. X-Ray Emitting States. 1973.

In heavy ion lecture series, 1972-73, Volume II.

Elementary systems of metastable atomic states of heavy ions are discussed, placing emphasis on analogs of hydrogen, helium, and lithium with extensions to heavier two electron systems such as oxygen and fluorine. Multipole radiations are considered and experimental arrangements for measuring lifetimes of excited states are examined. (16 figures) (SDF)

20809 (COO-2130-163, pp 352-379)) METASTABLE ATOMIC STATES OF HEAVY IONS. II. X-Ray and Auger Emitting States. 1973.

In heavy ion lecture series, 1972-73, Volume II.

Metastable atomic states of heavy ions are discussed. Topics include autoionization, Auger processes, and systems with three electrons. (24 figures) (SDF)

20810 (COO-2130-163, pp 380-414)) METASTABLE ATOMIC STATES OF HEAVY IONS. III. Auger Emitting States and Astrophysical Topics. 1973.

In heavy ion lecture series, 1972-73, Volume II.

Autoionization of metastable atomic states of heavy ions is discussed and systems with more than three electrons are briefly considered. The natural occurrence of metastable ions is examined. (2 tables, 33 figures) (SDF)

20811 TWO-LEVEL RADIATIVE SYSTEMS AND PERTURBATION THEORY. Hioe, F. T.; Montroll, E. W. (Univ. of Rochester, NY). J. Math. Phys. (N.Y.); 16: No. 6, 1259-1270(Jun 1975).

Expressions are obtained for the radiative level shifts of a two-level system in terms of (i) recurrence relations, (ii) ratios of determinants, (iii) continued fractions, and (iv) a Lidstone expansion. These expressions are shown to be very useful for numerical computations. It is pointed out that perturbation series in powers of the coupling constant are not the most appropriate way of representing the solutions of the problem, but if they are to be used, different series should be employed depending on the relative value of the frequency of the field to the frequency of the two-level system. The significance of these results in the general theory of perturbation is discussed. (auth)

20812 RAREFIED GAS DYNAMICS. Volume II. Proceedings of the Ninth International Symposium, Goettingen, Germany, July 15–20, 1974. Becker, M.; Fiebig, M. (eds.). Linder Hoehe, Ger.; DFVLR-Press (1974). vp. (CONF-740743-P2).

Separate abstracts are prepared for 8 papers. (CES)

For abstracts of individual papers see: 20792–20798, and 20813.

20813 MEASUREMENT OF ALIGNMENT OF ANGULAR MOMENTA OF DIATOMIC MOLECULES IN A SUPERSONIC BEAM. Korving, J.; Visser, A. G.; Douma, B. S.; 't Hooft, G. W.; Beenakker, J. J. M. (Univ. of Leiden, Netherlands). pp C.3.1-C.3.10 of Rarefied Gas Dynamics. Vol. II. Becker, M. (ed.). Linder Hoehe, Ger.; DFVLR-Press (1974).

From 9th international symposium on rarefied gas dynamics; Gottingen, F. R. Germany (15 Jul 1974). See CONF-740743-P2.

An apparatus has been constructed in which alignment of the angular momenta of diatomic molecules in a supersonic molecular

beam has been measured, using the technique of laser induced fluorescence. Experiments have been performed on iodine and sodium dimers. For both systems it appears that the angular momenta show a non-random distribution. For I_2 we found an effect of .15% while Na_2 shows a much larger effect, 4%. (4 figs) (auth)

20814 ON THE FERMI HOLE IN ATOMS. Moiseyev, N.; Katriel, J.; Boyd, R. J. (Technion-Israel Inst. of Tech, Haifa). J. Phys., B (London); 8: No. 8, L130-L133(1 Jun 1975).

A recent proposal for the evaluation of the shape of the Fermi hole in atoms is investigated. It is pointed out that the arbitrariness inherent in the Hartree-Fock orbitals introduces an ambiguity in the definition, which can be overcome by using the unorthogonalized Hartree orbitals. This is still not quite satisfactory, the use of a proper Hartree-Fock as well as a proper Hartree wavefunction, each independently optimized, being essential for obtaining the shape of the Fermi hole. Calculations demonstrating these points are presented for the 2^3S state of the helium isoelectronic sequence. (auth)

20815 OPTICALLY DETECTED SPIN LOCKING OF ZERO FIELD ELECTRONIC TRIPLET STATES AND CROSS RELAXATION IN THE ROTATING FRAME. Schuch, H. (Freie Univ. Berlin (F. R. Germany). Inst. fuer Molekuelphysik); Harris, C. B. (California Univ., Berkeley (USA). Dept. of Chemistry). Z. Naturforsch., A; 30: No. 3, 361-371(Mar 1975).

The spin locking method known from NMR is shown to be useful also in ESR for investigating spin lattice relaxation problems and "slow" motions, e.g., questions of energy transfer by triplet states in organic molecular crystals, and probing of nuclear quadrupolar splittings even smaller than the ESR line width at zero magnetic field. Optically detected ESR spin locking experiments for isolated triplet states in zero field are demonstrated. It is shown how the complication of incoming and decaying triplet states and relaxation between all three triplet sublevels has to be handled during spin locking. An application, the study of the cross-relaxation between electronic triplet spin states and deuteron or proton spins is presented. (GE)

20816 POPULATION DENSITIES OF EXCITED STATES OF HELIUM ATOMS IN A BRUSH CATHODE DISCHARGE IN A MAGNETIC FIELD. Ikee, R.; Takeyama, H. (Hiroshima Univ.). J. Quant. Spectrosc. Radiat. Transfer.; 15: No. 7/8, 701-703(Jul 1975).

Spectral line intensities emitted by a brush cathode helium discharge in a magnetic field have been measured for the $2\ ^1S$-n ^1P, $2\ ^1P$-n ^1S, $2\ ^1P$-n ^1D, $2\ ^3S$-n ^3P, $2\ ^3P$-n ^3S, and $2\ ^3P$-n ^3D series up to a principal quantum number $n = 10$ and the population densities of the excited states have been obtained. For $n \geq 5$, the states are in thermal equilibrium. The electron density and the electron temperature obtained from the Saha-Boltzmann equation are 1.7×10^{13} cm^{-3} and 0.17 eV. These values are in good agreement with the values obtained from the measured recombination continuum. For the lower states, measured populations are in good agreement with those calculated by Drawin, Emard and Katsonis on the basis of a collisional-radiative model. (auth)

20817 RAMAN PROCESSES IN THE HELIUM ATOM IN INTENSE FIELDS. Thareja, R. K.; Man-Mohan; Nayak, V.; Haque, S. N. (Univ. of Delhi). Aust. J. Phys.; 28: No. 1, 35-44 (Feb 1975).

Using the hydrogenic model for the helium atom, the amplitude of transition from states He(1s) to He(1s,nl) by absorption of N photons of an intense field together with the emission of one Raman photon is evaluated. From the general expression for the transition amplitude, the particular case of transition from He(1s) to He(1s,2p) is considered. The "reduced" transition amplitude is plotted against the number of photons N involved and against the intensity parameter y separately. It is found that the s wave contributes maximally to the transition amplitude. An important feature of the calculations is the appearance of nonlinear behaviour at high intensity. The dominance of higher order processes over lower ones at high intensity is also found. (auth)

Positronium, Muonium, and Muonic and Mesic Atoms and Molecules

Refer also to abstract 21050.

20818 (HU-TFT-75-5) ELECTRON LIQUID IN COLLECTIVE DESCRIPTION. II. Application to Positron Annihilation. Arponen, J.; Pajanne, E. (Helsinki Univ. (Finland). Research Inst. for Theoretical Physics). Feb 1975. 16p. Dep. NTIS (US Sales Only) $4.00.

Positron annihilation is studied by using the boson description of the electron gas. The electron–electron interactions are taken in RPA, whereas the positron–electron interaction is more accurately treated. The scheme corresponds to calculating certain very large sets of perturbation diagrams. Results for the positron annihilation probability, the pair-correlation function and the positron kinetic energy and chemical potential for various electron densities are given. The approach gives new insight into the nature of the low-density divergencies occurring in many calculations of positron annihilation. (auth)

20819 (LA-5994-MS) HADRONIC ATOMS AND TICKLISH NUCLEI: THE E2 NUCLEAR RESONANCE EFFECT. Leon, M. (Los Alamos Scientific Lab., N. Mex. (USA)). Jun 1975. 9p. Dep. NTIS $4.00.

The E2 nuclear resonance effect in hadronic atoms offers a way to increase the hadronic information that can be obtained from hadronic x-ray experiments. The effect occurs when an atomic deexcitation energy closely matches a nuclear excitation energy, so that some configuration mixing occurs. It shows up as an attenuation of some of the hadronic x-ray lines from a resonant versus a normal isotope target. The effect was observed very clearly in pionic cadmium in a recent LAMPF experiment. A planned LAMPF experiment will use the nuclear resonance effect to determine whether the p-wave pi-nucleus interaction does indeed become repulsive for Z greater than or equal to 35 as predicted. The effect also appears in the kaonic molybdenum data taken at LBL because several of the stable molybdenum isotopes are resonant. A number of promising cases for pi^-, K^-, anti p, and $SIGMA^-$ atoms are discussed and a spectacular and potentially very informative experiment on anti p – ^{100}Mo is proposed. (9 figures, 9 tables) (auth)

20820 (LBL-3857) MEASUREMENTS OF X RAYS AND gamma RAYS FROM STOPPED KAONS. Godfrey, G. L. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 9 May 1975. Contract W-7405-ENG-48. 114p. Dep. NTIS $8.75. Thesis.

Intensities of x rays and gamma rays from negative kaons stopped in elements, pure isotopes, and some compounds ranging from Z equals 2 through Z equals 92 have been measured. Included were x rays from K^- atoms, $SIGMA^-$ atoms, and pi^- atoms. Also some nuclear gamma rays associated with the stopped kaons were observed. The kaonic x-ray intensities for low n, DELTA n equals 1 transitions, varied from .1 to .5 x rays/K/sub stop/ and showed a remarkable oscillation as Z changed. Peaks occurred near elements with closed electron shells. Within experimental accuracy, isotopes of the same elements yielded equal intensities. By searching for mu^- from K^- yields mu^-anti nu it was concluded that less than or equal to 5 percent of the stopped kaons decayed before nuclear capture in those elements studied. A cascade calculation was performed that reasonably reproduced the DELTA n equals 1 intensities but gave DELTA n equals 2 intensities high by a factor of 2. Initial kaon distributions in n equals 30 proportional to (2l + 1) out to some l/sub max/ were used to begin the cascade. The value of l/sub max/ changed with Z. It is suggested that l/sub max/ might be related to an impact parameter picture with the lever arm equal to one-half the distance between the atoms in their lattice. (auth)

20821 (RL-75-050) EMISSION OF AUGER ELECTRONS IN mu-MESIC ATOMS AND ESCAPE OF CHARGED PARTICLES WHEN mu-MESONS ARE CAPTURED BY LIGHT (C,N,O) AND HEAVY (Ag, Br) NUCLEI. Batusov, Yu. A.; Bunyatov, S. A.; Vizireva, L.; Gulkanian, G. R.; Mirsalikhova, F.; Sidorov, V. M.; Chernev, Kh. (Joint Inst. for Nuclear Research, Dubna (USSR)). Mar 1975. Translation of JINR-P1-8205. 9p. Dep. NTIS (US Sales Only) $4.00.

Previously, several general characteristics were studied of the escape of charged particles when mu-mesons are captured by light (C,N,O) and heavy (Ag, Br) nuclei in photoemulsions. In order that a fuller and more accurate quantitative picture of this emission of charged particles may be obtained, the value of the probabilities of emission of Auger electrons with an energy of 20 to 100 keV from mesic atoms of heavy elements (a/sup h/) is here defined significantly more accurately. In addition the accuracy of the figure for light elements (a/sup l/) has also been somewhat improved. (4 tables) (UK)

20822 POSITRON LIFETIMES AND LINESHAPE FACTORS IN DEFORMED COPPER. Dauwe, C.; Dorikens, M.; Dorikens-Vanpraet, L.; Segers, D. (Ghent Rijksuniversiteit (Belgium). Natuurkundig Lab.). Appl. Phys.; 5: No. 2, 117-120(Nov 1974).

From 3rd International conference on positron annihilation; Otaniemi, Finland (7 Aug 1973). figs.; 1 tab.; 14 refs.

Measurements of positron annihilation lifetime and lineshape factors in deformed OFHC copper, for 14 different pairs of specimen, ranging up to 66% deformation, are discussed. The influence of annihilation in the source is carefully examined and the data are consequently corrected. The lifetime varies from

124 ps for annealed copper to 179 ps for dislocation saturated samples. Trapping cross sections and trapping efficiencies are calculated. The possibility of interference of vacancies formed during the deformation is discussed. (GE)

20823 COMMENTS ON THE LOCK-CRISP-WEST THEOREM WITH EXPERIMENTAL EXAMPLES. Beardsley, G. M.; Berko, S.; Mader, J. J.; Shulman, M. A. (Brandeis Univ., Waltham, Mass. (USA)). Appl. Phys.; 5: No. 4, 375-378(Jan 1975).

From 3rd international conference on positron annihilation, Otaniemi, Finland (7 Aug 1973). 4 figs.; 14 refs.

The application of the Lock-Crisp-West (LCW) theorem to positron-annihilation angular-correlation data for copper and germanium as well as to Compton profile data for germanium is presented and discussed. Deviations from the LCW prediction are observed for copper and for germanium, attributable to the positron's presence. In germanium the Compton results indicate near agreement with the LCW expectation; the sensitivity of the theorem is analyzed. (auth)

20824 EFFECT OF AN EXTERNAL ELECTRIC FIELD ON THE POSITRONIUM FORMATION IN THE POSITRON SPUR. Mogensen, O. E. (Danish Atomic Energy Commission, Risoe. Chemistry Dept.). Appl. Phys.; 6: No. 3, 315-322(Apr 1975).

1 fig.; 1 tab.; 50 refs.

The decrease of positronium (Ps) formation in condensed matter caused by the presence of an external electric field is discussed in terms of the spur reaction model of Ps formation. The rather few experimental results available are shown to be in good agreement with the predictions of the model. Many new results are predicted by use of the available radiation-chemistry results. The work is also a reply to Brandt, who estimated that the spur process of Ps formation is insignificant in hydrocarbons. It is shown that Brandt's estimate disagrees with well-established results of radiation chemistry. (auth)

20825 D ELECTRON CONTRIBUTION TO THE POSITRON ANNIHILATION IN TRANSITION METALS. Shrivastava, S. B.; Joshi, K. P.; Dubey, V. S. (Vikram Univ., Ujjain, India). Nuovo Cim.; 27B: No. 2, 240-244(11 Jun 1975).

The results of the two independent earlier calculations on the angular correlations and lifetimes of positron annihilation in transition metals are correlated. Some observations are made on the nature of the contributions of various effects on the d electron annihilation. The many-body effects are found to decrease for higher-Z metals. (auth)

20826 CORE ANNIHILATION RATES OF POSITRONS IN RARE-EARTH METALS. Joshi, K. P.; Shrivastava, S. B.; Dubey, V. S. (Vikram Univ., Ujjain, Italy). Nuovo Cim.; 27B: No. 2, 245-248(11 Jun 1975).

The core annihilation rates for rare-earth metals were studied. Some general observations on the nature of the core electron contribution were made and discussed. The core contribution is found to decrease with increasing atomic number on the average as $Z^{-\frac{1}{2}}$. The study confirms that the prominent contribution comes from 5s- and 5p-shell electrons. (auth)

Collision Phenomena

Refer also to abstracts 20786, 20787, 20795, 20803, and 20862.

20827 (ANL-8153, pp 62-69) MOLECULAR-BEAM STUDIES. Wexler, S.; Parks, E. K.; Young, C. E.; Dehmer, P. M.; Kuhry, J. G.; Cohen, R. B.; Robo, L. G. Jan 1975.

In Chemistry Division annual report, July 1973-June 1974. (Argonne National Lab., Ill. (USA)).

Highlights of experimental results obtained with chemical accelerators are described under the following headings: development of an aerodynamic source of fast I atoms and I_2 molecules; chemi-ionization processes in collisions of uranium atoms with oxygen molecules; chemi-ionization reactions in other metal-O_2 collisions (La, Ce, Th); kinetic surface ionization; and single-crystal beam source. Relative cross sections for formation of various collision products are shown, as a function of energy in the eV range. (12 figures) (RWR)

20828 (CONF-750705-3) BASIC ASPECTS OF SECONDARY ELECTRON DISTRIBUTIONS. Kim, Y. K. (Argonne National Lab., Ill. (USA)). Jul 1975. Contract W-31-109-Eng-38. 15p. Dep. NTIS $4.00.

From ninth international conference on physics of electronic and atomic collisions; Seattle, Washington, USA (24 Jul 1975).

Graphical methods proposed by Platzman and by Fano are applied to the analysis of the basic features observed in secondary electron spectra. These methods are useful not only in checking the consistency of experimental data, but also in extrapolating the spectra to the range of primary- and secondary-electron energies not covered by experiments. Illustrative examples are presented for He, Ne, and NO. (auth)

20829 (COO-2130-163, pp 171-187) HOMONUCLEAR QUASI-MOLECULE PICTURE FOR ION-ATOM COLLISIONS. 1973.

In heavy ion lecture series, 1972-73, Volume II.

Low energy ion-atom collisions are described by building quasi-molecules from the collision partners. Reference is made to correlation diagrams and vacancy production. Calculations of Briggs and Macek are outlined for production of inner shell vacancies in $neon^{+}$-neon collisions. The extraction of cross sections is also examined. (SDF)

20830 (COO-2130-163, pp 188-207)) DIABATIC MODELS AND SPECTRAL FEATURES. 1973.

In heavy ion lecture series, 1972-73, Volume II.

The use of correlation diagrams for explaining gross phenomena is discussed. Diabatic models of ion-atom collisions are considered and characteristic spectral features are analyzed. (SDF)

20831 (GSI-tr-3/75) STEP-BY-STEP IONIZATION OF CHARGED CARBON AND NITROGEN IONS BY MEANS OF ELECTRON COLLISION ($C^{2+} \rightarrow C^{3+} \rightarrow C^{4+} \rightarrow C^{5+} \rightarrow C^{6+}$ AND $N^{3+} \rightarrow N^{4+} \rightarrow N^{5+} \rightarrow N^{6+} \rightarrow N^{7+}$). Donets, E. D.; Ilyushchenko, V. I. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (F.R. Germany)). Mar 1975. 23p. (In German). INIS.

11 figs.; 6 tabs.; 57 refs. Translated from the Russian report JINR-P7-8310, Dubna 1974.

The ionizing probabilities and methods of investigation of step-by-step ionization of positively charged ions by electron impact with crossed beams are described, and the experimental and theoretical values of C and N ion ionization with ion traps (IEL-KRION, HIPAC) are given together with an analysis of the results and a physical interpretation. (GE)

20832 (INIS-mf-1766, pp 59-82) IONIZATION AND FRAGMENTATION OF ANILINE AND OTHER ORGANIC MOLECULES IN COLLISIONS WITH HALOGEN ATOMS IN THE ELECTRONVOLT ENERGY RANGE. Chapter 4. Koennen, G. P.; Grosser, J.; Haring, A.; Eerkens, F.; Vries, A. E. de; Kistemaker, J. 18 Sep 1974.

In energy distributions of sputtered neutrals and electron transfer and reactive ionization in atom-molecule collisions. (Amsterdam Univ. (Netherlands)).

Ionization and fragmentation of aniline, n-propylbenzene, carbon-tetrachloride, benzene, propane and cyclohexane are studied under halogen impact. The energy dependences of the ionization cross sections of aniline in collisions with halogens are reported. The results show an analogy with electron impact and photo-ionization mass spectroscopy. They are discussed in terms of potential curve crossings in the halogen organic molecule system. (INIS)

20833 (INIS-mf-1766, pp 83-95) ELECTRON TRANSFER AND REACTIVE IONIZATION IN $C + O_2$ COLLISIONS IN THE ELECTRONVOLT ENERGY RANGE. Chapter 5. Koennen, G. P.; Haring, A.; Vries, A. E. de 18 Sep 1974.

In energy distributions of sputtered neutrals and electron transfer and reactive ionization in atom-molecule collisions. (Amsterdam Univ. (Netherlands)).

Cross sections for ion formation in $C + O_2$ collisions have been measured as a function of the kinetic energy up to 15 eV. Charge transfer is found to give rise to C^{+}, O_2^{+}, O^{-}, C^{-}, O_2^{+} and free electrons. Five processes leading to these ions have been identified. Reactive ionization takes place, proceeding according to three processes: $C + O_2$, $CO^{+} + O + e^{-}$, $CO^{+} + O^{-}$ and $CO + O^{+} + e^{-}$. (auth)

20834 (JUL-1154) ION-PHOTON COINCIDENCE EXPERIMENTS FOR THE STUDY OF K-SHELL EXCITATION IN Ne^{+}-Ne COLLISIONS IN THE ENERGY RANGE OF SEVERAL HUNDRED keV. Sackmann, S. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik; Koeln Univ. (F. R. Germany)). Jan 1975. 67p. (In German). INIS.

12 figs.; 2 tabs.; 55 refs.

Ne^{+} ions with energies of 235 and 363 keV were scattered on a Ne gas target. The Ne K X radiation emitted after the collisions was measured in coincidence with ions scattered at angles between 3° and 36°. From the data the impact parameter dependence of the K-shell excitation was calculated for an exponentially screened Coulomb potential and compared with the theory of Briggs and Macek. The characteristic change in the energy curve postulated by the theory is shown by the experimental results. (GE)

20835 (NP-20480(P8), pp 97-98) INNER-SHELL EXCITATION BY NITROGEN IONS AND ALPHA PARTICLES (3). Awaya, Y.; Izumo, K.; Hamada T.; Okano, M.; Hashizume, A.; Takahashi, T.; Tendow, Y.; Katou, T. Dec 1974.

In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

20836 (ORNL-5025, pp 138-146) ATOMIC STRUCTURE AND COLLISION EXPERIMENTS. Sellin, I. A.; Brown, M. D.; Forester, J. P. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

The lifetimes of the metastable $(1s2s2p)^4p^0$/sub 5/2/ state in ions of the lithium sequence have been measured for Al^{10+}, Si^{11+}, S^{13+}, as an extension of earlier measurements for O^{5+}, F^{6+}, Cl^{14+}, and Ar^{15+}. Comparison is made with autoionization and M2 rate calculations for this state in ions from Z equals 3 to 26. Beam foil spectroscopy was used to obtain spectra of one-, two-, three-, four-, and five-electron oxygen and fluorine in the wavelength region 70 to 200 A. A typical spectrum is shown. Studies of noncharacteristic x-ray emission from heavy ion collisions are presented for Al-Al, Si-Al, GC, O-C, and Ni-Ni. Examples of electron spectra resulting from Li^+ and Na^+ collisions with a helium target are shown, and the advantage of alkali beams over alkali targets is pointed out. Measurements of the charge states of ions in dense media by applying the charge-state dependence of K x-ray production in gases are described, and results of high resolution studies of x-rays from impact of high charge-state energetic heavy ions on gases are reported. (8 figures) (GHT)

20837 THRESHOLD LAW FOR A MODEL WITH LONG-RANGE INTERACTIONS. Damburg, R.; Fabrikant, I. (Inst. of Physics, Riga). Latv. PSR Zinat. Akad. Vestis, Fiz. Teh. Zinat. Ser.; No. 2, 8-11(1975). (In Russian).

The model of two nondegenerate equations coupled by αr^{-2} potential is considered. In the new channel potential qr^{-3} is presented. Threshold laws for the scattering cross section from the excited state and the excitation cross section are obtained. (auth)

20838 PHENOMENA ASSOCIATED WITH NEAR-THRESHOLD EXCITATION OF AUTOIONIZING LEVELS OF HELIUM BY ELECTRON IMPACT. Taylor, H. S.; Yaris, R. (Technische Univ., Munich). J. Phys., B (London); 8: No. 7, L109-L112(11 May 1975).

An explanation which is based on a resonance model is proposed for the phenomena associated with the "displaced threshold". (auth)

20839 GLAUBER-TYPE APPROXIMATION IN IMPACT PARAMETER TREATMENT. Dewangan, D. P. (Queen's Univ., Belfast). J. Phys., B (London); 8: No. 7, L119-L121(11 May 1975).

Within the framework of the semiclassical impact parameter method, a Glauber-type high-energy approximation for rearrangement collisions is formulated. The theory is applied to the capture of an electron by a proton passing through hydrogen and a closed expression for the transition probability is derived. (auth)

20840 ELECTRON LOSS FROM FAST HYDROGEN ATOMS PASSING THROUGH ATOMIC HYDROGEN. Bates, D. R. (Queen's Univ., Belfast). J. Phys., B (London); 8: No. 7, L117-L118 (11 May 1975).

Criticisms of calculations by Bates and Griffing (Proc. Phys. Soc.; A67: 663-8 (1954 and A68: 90-6 (1955)) are refuted. (auth)

20841 ELECTRONIC RELATIVISTIC EFFECTS IN THE K-SHELL COULOMB IONIZATION OF HEAVY ATOMS BY MASSIVE CHARGED PARTICLES. Amundsen, P. A.; Kocbach, L. (Bergen Univ., Norway). J. Phys., B (London); 8: No. 7, L122-L126(11 May 1975).

The straight line semiclassical approximation with relativistic Coulomb functions for the electrons is applied to the ionization process. Only the $l = 0$ final state electrons are considered. The effects of Coulomb deflection of the projectile are taken into account. The agreement between theory and experiment is considerably improved. (auth)

20842 EXCITATION PROCESSES IN LOW-ENERGY COLLISIONS BETWEEN GROUND STATE HELIUM ATOMS. Kempter, V.; Veith, F.; Zehnle, L. (Univ., Freiburg i. B.). J. Phys., B (London); 8: No. 7, 1041-1052(11 May 1975).

Apparent threshold energies have been measured for excitation of the He states 2^1P, 3^1D, 3^3P, 3^3D, 4^1S, and 4^3S in collisions between ground state He atoms. The energy dependence of the cross sections for emission of the He lines $2^1P \rightarrow 1^1S$, $3^3P \rightarrow 2^3S$, $3^1D \rightarrow 2^1P$, $3^3D \rightarrow 2^3P$, $4^1S \rightarrow 2^1P$, and $4^3S \rightarrow 2^3P$ has been measured from the respective thresholds up to about 600 eV collision energy. Estimates are given for the absolute values of the cross sections in this range. The emission from states He(3D) shows structure which is due to phase-interference effects. (auth)

20843 ABSOLUTE DIFFERENTIAL CROSS SECTIONS FOR ELASTIC SCATTERING OF ELECTRONS BY HELIUM, NEON, ARGON, AND MOLECULAR NITROGEN. Jansen, R. H. J.; de Heer, F. J.; Luyken, H. J.; van Wingerden, B. (Stichting voor Fundamenteel Onderzoek der Materie, Amsterdam). pp 15-79 of Elastic Scattering of Electrons by Noble Gas Atoms and Nitrogen Molecules. Jansen, R. H. J. (ed.). Amsterdam; Amsterdam Univ. (7 May 1975).

This is a description of an improved electron spectrometer of the Kuyatt-Simpson type. It is an extension of a report by the same authors (FOM nr. 35693, 1974) measuring the absolute differential cross section for N_2 at 500 eV and at scattering angles between 5° and 9°; and relative cross sections of He, Ne, Ar and N_2 at 100 to 3000 eV and scattering angles between 5° and 55°. Improved energy dependence measurements used in the normalization procedure made it possible to obtain a consistent set of absolute cross sections independent of any other experiment or theory. An extensive comparison with experimental and theoretical data from literature is given. Analysis of the exponential behavior of the differential cross section as a function of momentum transfer yielded apparent polarizabilities of the target. Total scattering cross sections were derived from the gas pressure dependence of the scattered signal. (auth)

20844 RESONANT SCATTERING PARAMETERS FOR ATOMIC OR MOLECULAR HYDROGEN IN PLASMAS SIMULTANEOUSLY IRRADIATED WITH VACUUM UV AND VISIBLE LIGHT. Norton, B. A. (Royal Holloway Coll., Egham (UK). Dept. of Physics). Z. Naturforsch., A; 29: No. 12, 1937-1938(Dec 1974). (In German).

Simultaneous resonant scattering of Lyman and Balmer radiation in low-density ($N_e \lesssim 10^{14}$ cm^{-3}) hydrogen plasmas has been examined. The equations governing the rates of population of the first few excited levels are solved in the case of intense pumping. Parameters are obtained which relate the total atomic or molecular density to the population density in the third level and thus also to the intensity of the first Balmer line which is easy to measure experimentally. A possible means of obtaining sufficient UV power for this method is also discussed. (auth)

20845 THEORY OF COLLISION EFFECTS ON ATOMIC AND MOLECULAR LINE SHAPES. Berman, P. R. (New York Univ., N. Y. (USA). Dept. of Physics). Appl. Phys.; 6: No. 3, 283-296(Apr 1975).

A review of recent developments in the theory of the effects of binary collisions on the spectral profiles associated with atomic and molecular systems is presented. To account consistently for collisional perturbations of both systems, the internal energy levels and the velocity of active (emitting or absorbing) atoms have been quantized. Following this procedure general equations for absorption or emission line shapes are obtained. The line shapes may exhibit narrowing or broadening with increasing perturber pressure, depending upon the nature of the collision interaction. The physical significance of the collision mechanisms giving rise to such behavior is discussed, as is the experimental evidence in support of the theory. Various applications of the theory are presented. (auth)

20846 EXCITATION TRANSFER BETWEEN EXCITED ELECTRONIC STATES OF THE H_2 MOLECULE DUE TO INTERACTION WITH A CO_2 LASER BEAM. Dubreuil, B.; Chapelle, J. (Centre National de la Recherche Scientifique, 45 - Orleans-la-Source (France). Centre de Recherches sur la Physique des Hautes Temperatures); Drawin, H. W. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Section de Physique des Plasmas). Z. Phys., B; 20: No. 1, 117-122(1975).

A spectroscopic study of the band systems $G1\Sigma \rightarrow B1\Sigma$ and $J1Pi \rightarrow B1\Sigma$ of H_2 emitted by a glow discharge in H_2 gas showed that the populations of the $G1\Sigma$ states decrease for the benefit of the J1Pi states when the discharge is irradiated by a powerful CO_2 laser beam (power density 70 kW/cm^2). The effect is interpreted as an absorption process in which two laser photons intervene according to the transition scheme: $G1\Sigma \rightarrow B1\Sigma \rightarrow J1Pi$. A change of the populations of excited electronic states should lead to a change of the populations of excited atomic states as well. (auth)

20847 ANGULAR CORRELATION OF OUTGOING ELECTRONS FOLLOWING IONIZATION OF H_2 AND N_2 BY ELECTRON IMPACT. Jung, K.; Schubert, E.; Paul, D. A. L.; Ehrhardt, H. (Trier-Kaiserslautern Univ., Kaiserslautern, Ger.). J. Phys., B (London); 8: No. 8, 1330-1337(1 Jun 1975).

Electron-electron angular correlations have been measured for the ionization of molecular hydrogen and nitrogen by electron impact at 100 eV incident electron energy and also at 250 eV for hydrogen. A total of 18 cases were studied at various secondary energies and primary scattering angles. Strong binary peaks were observed in all cases resembling what would be expected from the ionization of atoms having similar electronic structures. The recoil peaks which were observed were, however, generally weak, especially with nitrogen. A first attempt at determining part of the six-fold differential cross section for molecular

hydrogen was made by varying the energy of the lower energy secondary electron while all other scattering parameters were held constant. The result was obtained in the binary peak and shows the vibrational excitation of the residual ion. The observed structure is in reasonable agreement with a computed curve based on Dunn's calculated Franck-Condon factors for the ionization of H_2. (auth)

20848 INTERFERENCE EFFECTS IN 4^3S AND 4^1S EXCITATION, IN He^+ ON He COLLISIONS AT LOW ENERGIES. Rahmat, G.; Vassilev, G.; Baudon, J. (Paris Univ., Orsay, France). J. Phys., B (London); 8: No. 8, 1302-1316(1 Jun 1975).

Differential cross sections for 4^3S and 4^1S excitation of He in He^+ on He collisions have been measured in the energy range 94 eV to 120 eV and in the angular range 8 to 17 degrees (in the laboratory frame) by detecting, in delayed coincidence, the scattered ions and the emitted photons (λ = 5047 Å, 4713 Å). Relative values of the corresponding total cross sections have also been determined, from 60 eV up to 3 keV. Below 400 eV they oscillate in opposite phase as functions of energy. This behavior can be explained by the Rosenthal model. A long range crossing (at 36 bohr) makes the inelastic amplitudes produced by radial couplings interfere at the inner crossing points (1.3 bohr). A double system of oscillations is observed in the differential cross sections. It is interpreted as Stueckelberg interference, coming from inner crossings, combined with a nuclear symmetry interference effect. Calculations of the differential and total cross sections have been carried out using a three-state semi-quantal method, Landau-Zener probabilities and analytic functions for diabatic potentials. Satisfactory agreement between calculated and measured cross sections is obtained. (auth)

20849 S-WAVE ELASTIC SCATTERING OF POSITRONS BY HELIUM IN THE COUPLED STATIC APPROXIMATION. Ho, Y. K.; Fraser, P. A.; Kraidy, M. (Univ. of Western Ontario, London). J. Phys., B (London); 8: No. 8, 1289-1301(1 Jun 1975).

S-wave phase shifts for the positron-helium elastic scattering problem are presented in the coupled static approximation (i.e., the trial function contains the ground states of both the target atom and positronium, but no other terms). Various models of the target atom wavefunction are employed, two of which confirm qualitatively the marked effect on the results as reported by Wardle for these models. While none of the target models used in this approximation appears to lead to an adequate description of the system, as is also the case in positron-hydrogen scattering in the same approximation, a qualitative comparison of the best results presented here and the corresponding approximation in the hydrogen case suggests a manageable calculation with two open channels (i.e., with real positronium formation) could produce meaningful results. (auth)

20850 TWO-ELECTRON PHOTOIONIZATION OF HELIUM. Amusia, M. Ya.; Drukarev, E. G.; Gorshkov, V. G.; Kazachkov, M. P. (Physical-Technical Inst., Leningrad). J. Phys., B (London); 8: No. 8, 1248-1266(1 Jun 1975).

Cross sections of such processes as double photoionization and photoionization accompanied by excitation of He-like atomic systems are investigated in the limit of high, but still not relativistic, photon energies. In addition to total cross sections electron energy and angular distributions are also obtained. Coulomb wave and Green functions were employed in the momentum representation. The only model assumption is that of first-order perturbation theory with respect to interelectron Coulomb interaction in the ground state wavefunction. Results for the total double ionization cross section as a function of photon energy are close to those obtained by predecessors with much more complicated ground state wavefunctions. The cross section of ionization with simultaneous excitation differs considerably from those obtained before. Angular and energy distributions of ionized electrons, are investigated. No conclusive comparison to experimental data is possible due to the high photon energy requirement of the study. (auth)

20851 ABSOLUTE DIFFERENTIAL CROSS SECTIONS FOR 100 eV ELECTRONS ELASTICALLY SCATTERED BY HELIUM, NEON, AND ARGON. Gupta, S. C.; Rees, J. A. (Liverpool Univ., Eng.). J. Phys., B (London); 8: No. 8, 1267-1274(1 Jun 1975).

Recent measurements of the angular differential cross sections for the elastic scattering of electrons of 100 eV energy in helium, neon, and argon over an angular range 10 to 150 degrees are discussed. The observed relative differential cross sections for neon and argon have been converted to an absolute scale by measuring differential scattering in 10% and 10.3% mixtures of neon and argon respectively in helium and using available cross section data for helium for angles of 30° and 50°. Differential cross sections for 100 eV electrons in helium are also deduced from the mixture experiments. The results are compared with other measurements and with recent calculations. In particular, the agreement of the present results with the absolute data of Jansen et al for angles of 50° and below is found to be excellent and extends the data to 150°. (auth)

20852 USE OF SECOND-ORDER POTENTIALS IN THE THEORY OF SCATTERING OF CHARGED PARTICLES BY ATOMS. IX. The Excitation of Hydrogen and Helium to the n = 2, S Levels by Electron Impact. Bransden, B. H.; Winters, K. H. (Durham Univ., Eng.). J. Phys., B (London); 8: No. 8, 1236-1244(1 Jun 1975).

Differential cross sections for the excitation from the ground state to the 2^1S and 2^3S states of helium and to the (2s) state of atomic hydrogen by electrons, are calculated for incident energies of 50 to 200 eV. A wavefunction calculated by Winters et al, is employed to describe the incident channel, making allowance for absorption, polarization and exchange effects. Final state scattering is taken into account through a distorted wave formalism. The results provide a generally satisfactory representation of experiment, although it is considered that improvements could be obtained by including the coupling between the final states and the neighbouring 2P states. (auth)

20853 ELASTIC SCATTERING OF ELECTRONS BY HYDROGEN ATOMS AT INTERMEDIATE ENERGIES. Jhanwar, B. L.; Khare, S. P.; Shobha, P. (Meerut Univ., India). J. Phys., B (London); 8: No. 8, 1228-1235(1 Jun 1975).

Elastic scattering of electrons by hydrogen atoms has been investigated in the plane wave approximation in 50 to 200 eV energy range. A general expression has been derived for the non-adiabatic potential in a Hermitian form. First-order perturbed wavefunctions and pseudo-states are employed to construct dynamic polarization potentials. The theory underestimates the differential cross sections, but the shapes of the theoretical curves are in agreement with the experimental data. The present results are also in fair agreement with more sophisticated calculations. (auth)

20854 RELAXATION OF He(3^1S, 3^3S, 3^3P) STATES IN Ne, Ar, Kr, AND Xe COLLISIONS. Kubota, S.; Davies, C.; King, T. A. (Manchester Univ., Eng.). J. Phys., B (London); 8: No. 8, 1220-1227(1 Jun 1975).

De-excitation of He(3^1S, 3^3S) states by collisions with Ne, Ar, Kr and Xe atoms is mainly attributed to chemi-ionization. For He(3^3P) states relaxation is attributed to chemi-ionization and a collisional radiative process to He(2^3S) states. De-excitation cross sections in 10^{-16} cm^2) at 600($^{+300}_{-100}$)K, are: for He(3^1S): Ne 20.7, Ar 14.2, Kr 16.1, Xe 61.3; for He (3^3S): Ne 24.3, Ar 22.8, Kr 24.2, Xe 49.2; for He(3^3P): Ne 24, Ar 25.0, Kr 21.5 and Xe 64.0. (auth)

20855 MEASUREMENTS OF CROSS SECTIONS FOR THE PRODUCTION OF PROTONS BY COLLISION BETWEEN ELECTRONS AND VIBRATIONALLY DE-EXCITED H_3^+ IONS. Peart, B.; Dolder, K. T. (Newcastle Upon Tyne Univ., Eng.). J. Phys., B (London); 8: No. 8, L143-L145(1 Jun 1975).

The results of two experiments are reported. In the first, cross sections were measured for the production of protons by collisions between electrons and vibrationally de-excited H_3^+ ions for interaction energies between 29 and 611 eV. This experiment employed electron and ion beams which intersected at right angles ($\theta = 90°$). In the second experiment inclined beams ($\theta = 10°$) were used to investigate lower interaction energies (19.2 to 29.5 eV) because it was found that the cross section increased rapidly with energy between 20 and 30 eV. The cross section reached a maximum value of 7.6×10^{-16} cm^2 at 79 eV and the systematic errors were assessed to be less than ±6%. (auth)

20856 NOTE ON THE EXCHANGE INTEGRALS IN THE IMPACT-PARAMETER TREATMENT OF HEAVY-PARTICLE COLLISIONS. Shakeshaft, R. (New York Univ., NY). J. Phys., B (London); 8: No. 8, L134-L136(1 Jun 1975).

The one-electron three-dimensional exchange integrals which arise in the impact-parameter treatment of heavy-particle collisions are reduced to one-dimensional integrals whose ranges are finite, and whose integrands contain only simple exponential functions. (auth)

20857 CROSSED BEAM MEASUREMENTS OF Ar–Ar TOTAL CROSS-SECTIONS WITH A TIME-OF-FLIGHT MACHINE. Beijerinck, H. C. W.; Habets, A. H. M.; Verster, N. F. (Eindhoven Univ., of Tech., Netherlands). pp B.34.1-B.35.1 of Rarefied Gas Dynamics. Vol. I. Becker, M. (Ed.). Linder Hoehe, Ger.; DFVLR-Press (1974).

From 9th international symposium on rarefied gas dynamics; Gottingen, F.R. Germany (15 Jul 1974). See CONF-740743-P1.

With the time-of-flight method the total cross-section at all velocities of the main beam during each period was measured, eliminating, on a time scale of milliseconds, errors due to density

fluctuations at the scattering center. In the apparatus, extensive 20 K cryopumping was used, resulting in a working pressure lower than 2×10^{-8} torr. The secondary beam was a cryopumped supersonic beam, with a 1° opening half angle. For relative velocities $g > 1000$ m/s the velocity resolution was better than 3%, determined mainly by the opening angle and the velocity spread of the secondary beam. Preliminary results are given for the Ar–Ar system. (2 figs, 13 refs) (auth)

20858 POLARIZATION POTENTIAL FOR LOW-ENERGY ELASTIC SCATTERING: e^+-He. Hashino, T.; Nakazaki, S. (Miyazaki Univ. (Japan). Faculty of Engineering). Miyazaki Daigaku Kogakubu Kenkyu Hokoku; No. 19, 81-85(Aug 1973). (In Japanese).

A polarization potential calculation is given for elastic scattering of slow positrons by helium atoms. The potential is determined in the adiabatic approximation by a simple variational calculation, minimizing the energy of the disturbed atom. This method is more general than the method of polarized orbitals. Using this method, the scattering length and partial cross sections for the elastic scattering are evaluated in the dipole approximation and are compared with our previous results obtained using the method of polarized orbitals. (auth)

20859 MICRO-CHANNEL PLATE TYPE IMAGE-INTENSIFYING DETECTOR SYSTEM FOR SPECTROSCOPIC STUDY ON ELECTRONIC AND ATOMIC COLLISIONS BY CROSSED-BEAM TECHNIQUE. Kimura, M.; Iwai, T.; Horie, T. (Osaka Univ., Toyonaka (Japan). Dept. of Physics). J. Phys. Soc. Jap.; 37: No. 6, 1606-1611(Dec 1974).

A micro-channel plate dynode type image intensifier whose output window is a fibre face plate coated with phosphor on its inner surface has been applied to a low f-number spectroscopic detector for studies of very weak light signals sent from the crossing between an electronic or ionic beam and an atomic or molecular beam. It can reduce long exposures extending over nights for optimum density spectrograms to be obtained in the conventional way, down to scores of minutes and to several seconds. The resolution and sensitivity are both nearly satisfactory, as far as atomic lines, continua, and diatomic bandheads are concerned. (auth)

20860 SEARCH FOR ADDITIONAL RESONANCES IN E^- HELIUM SCATTERING BELOW THE FIRST EXCITATION THRESHOLD. Andrick, D.; Langhans, L. (Trier-Kaiserslautern Univ., Kaiserslautern, Ger.). J. Phys., B (London); 8: No. 8, 1245-1247(1 Jun 1975).

Apart from the well known ^2S negative ion state found in e^--He scattering, additional p and d wave resonances below the first excitation threshold have been reported by other authors. A careful experimental investigation of the differential cross section does not confirm these observations. If such resonances exist, their width should be smaller than 10 μeV. (auth)

20861 LOW-ENERGY PROTON BOMBARDMENT OF CARBON DIOXIDE. Ray, K. D.; Bhutani, K. K.; Ghosh, S. N. (Univ. of Allahabad, India). Indian J. Radio Space Phys.; 3: No. 4, 416-418(Dec 1974).

Carbon dioxide, the major constituent of Martian and Venusian atmospheres, was bombarded by protons having energy in the range 0.5 to 2 keV. The excited spectra in order of intensity consisted of Angström and 3PG system of CO, comet tail bands of CO^+ and H_α and H_β lines. It was observed that the intensities of Angström and 3PG bands increase and those of comet tail bands of CO^+ and H_β line decrease with proton energy. The excitation of the bands has been attributed to the dissociation of CO_2 and charge exchange with protons. The spectra excited by proton bombardment were compared with those obtained by microwave discharge of CO_2 and their differences explained. (1 fig., 11 refs.) (auth)

Atomic Theory

20862 (LBL-3647) NONPERTURBATIVE THEORY OF SINGLE/MULTIPHOTON PROCESSES IN ATOMS AND MOLECULES INDUCED BY INTENSE LASER FIELDS. Lau, A.M.F. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Apr 1975. Contract W-7405-ENG-48. 58p. Dep. NTIS $6.00. Thesis.

A quantum nonperturbative theory is given for the problem of a general n discrete-level atomic/molecular system interacting with a strong single-mode/multimode radiation field. The atomic/molecular energy-level structures are modified due to interaction with the laser field. These energy level shifts are derived in the rigorous solution to the adiabatic eigenvalue problem of the charge–field system, involving a simple iterative procedure. The task of solution is simplified by recurrence relations between matrices connecting probability amplitudes of successive photon numbers. New formulae for calculating probability of single/multiphoton transitions between three resonant shifted levels and between some cases of two near-resonant shifted levels are derived. This general formalism can be applied to calculate transition probabilities of various atomic/molecular photo processes of interest. Numerical values are obtained for the inelastic cross section of the slow-collisional process Li + H and for dissociation cross section of LiH molecule. The transition probabilities of Na (3s yields 5s by absorption of two photon of lambda equals 0.60233 mu – 0.602396 mu) and of Li (2s yields 3s by absorption of eight photons of lambda equals 2.9406 mu – 2.945 mu) irradiated by a strong pulse are calculated. Finally, a parametric study is carried out for the process where a molecular system is interacting with two intense radiation fields of different wavelengths. Owing to potential barrier shift due to the much more intense field, the molecular system penetrates into an otherwise inaccessible region in the potential level where it is allowed to radiate to a lower level by emitting photons at a second wavelength. (12 figures, 6 tables) (auth)

20863 POSSIBLE ACCELERATIVE SPECTRAL EFFECT. Burcev, P. (J. E. Purkyne Univ., Brno). Phys. Lett.; 51A: No. 2, 81-82(10 Feb 1975).

A possible splitting of spectral lines, similar to the Stark effect, due to acceleration of an ion in an electromagnetic field is discussed. (auth)

PHYSICS (ELECTROFLUID AND MAGNETOFLUID)

20864 ELECTROGASODYNAMIC EFFECTS AND THEIR APPLICATIONS. Bortnikov, Yu. S.; Rubashov, I. G. Magn. Gidrodin.; No. 1, 23-34(1975). (In Russian).

Problems of electrogasdynamics—a new promising field of science and technology—are considered. A short historical review is given of the development of electrogasdynamics, the present state of the studies, and possible future developments are discussed. Conclusions concerning the high potential possibilities of this field, which should have large effects on achievements in other areas—are presented. 68 references. (tr-auth)

20865 METHODOLOGY AND RESULTS OF CAVITATION TESTS OF CONDUCTION MAGNETOHYDRODYNAMIC MACHINES IN A FLOW-METER REGIME. Bocheninskii, V. P.; Emelin, Yu. B.; Tananaev, A. V.; Ushakov, Yu. P. Magn. Gidrodin.; No. 4, 121-126(1974). (In Russian).

New experimental data were obtained on cavitation in a conduction magnetohydrodynamic machine operated in a flow-meter regime. The moment of origin of cavitation was determined by a "stripping characteristic" method by analysis of the acoustic noise and measurements of the potential drop at the electrodes. Electrical values were the most sensitive to the appearance of cavitation in a mercury current. This shows new possibilities for determining the origin and development of cavitation. An equivalent electrical diagram of a magnetohydrodynamic machine was examined, which explains the possible principles of an anomalous type of V–Q characteristic (potential drop vs flow) in the origin of cavitation. The change in conductivity of the working medium and contact resistance were considered the basic principles. (tr-auth)

20866 PLANE UNSTEADY FLOW OF A CONDUCTING NON-NEWTONIAN LIQUID. Granik, I. S.; Martinson, L. K. Magn. Gidrodin.; No. 4, 141-151(1974). (In Russian).

The plane unsteady problem of displaced flows of a conducting incompressible liquid was studied with the exponential rheological law in a transverse magnetic field whose induction depends on time and the rate of a plate located in the liquid changes exponentially with time. A generalized solution was found in the form of a power series. The limiting conversion to a nonconducting liquid was examined. (tr-auth)

20867 MAGNETOHYDRODYNAMIC FLOW OF AN INCOMPRESSIBLE VISCOUS FLUID DUE TO DEFORMATION OF A PLANE SURFACE. Pavlov, K. B. Magn. Gidrodin.; No. 4, 146-147(1974). (In Russian).

The problem of movement of a conducting incompressible viscous fluid, due to deformation elongation of a plane elastic surface in a transverse magnetic field, was solved in an approximation of the boundary layer theory. (tr-auth)

20868 MECHANISM OF INSTABILITY OF AN ELECTRICALLY CONDUCTING LIQUID IN A CONDUCTION MAGNETOHYDRODYNAMIC STRUCTURE. Kukainis, O. A.; Shishko, A. Ya. Magn. Gidrodin.; No. 4, 109-115(1974). (In Russian).

The stability of a homogeneous electrically conducting liquid inclosed in a rectangular closed cavity and in crossed electrical and magnetic fields was examined. With a small gradient in the magnetic field directed parallel to the action of the electromagnetic force, in a two-dimensional approximation a system of equations was obtained relating the rate disturbance to the disturbances of the magnetic field. It was shown that with certain ratios between the gradient of the magnetic field and the density of the current passing through the cavity an instability may arise in the cavity. A precise solution was obtained describing the spectrum of the plane disturbances in a long cavity. (tr-auth)

20869 THREE-DIMENSIONAL DISTRIBUTION OF ELECTRICAL POTENTIAL FOR CYLINDRICAL CHANNELS. Rvachev, V. L.; Sheiko, T. I. Magn. Gidrodin.; No. 4, 53-56(1974). (In Russian).

A solution was found for the three-dimensional problem of distribution of electrical potential in the flow of a conducting medium in a nonhomogeneous magnetic field along a cylindrical channel with nonconducting walls. Results were obtained for different types of magnetic fields. The general solution is given for an arbitrary magnetic field $B_x = B_x(z)$. The Fourier integral transform was used in the solution of the problem. (tr-auth)

20870 MAGNETOHYDRODYNAMIC ROTATION OF ELECTRICALLY CONDUCTING LIQUID IN A CYLINDRICAL VESSEL OF FINITE DIMENSIONS. Gorbachev, L. P.; Nikitin, N. V.; Ustinov, A. L. Magn. Gidrodin.; No. 4, 32-42(1974). (In Russian).

The movement of an electrically conducting liquid in a cylindrical vessel of finite height was studied theoretically and experimentally under the action of crossed E–B fields and in a rotating magnetic field. The case of large hydrodynamic and small magnetic Reynolds numbers was examined. Expressions were found for circumferential, axial, and radial component velocities in all fields of flow. A thermo-anemometric method was used to measure the circumferential component of the rate of a KOH solution set in motion by a rotating magnetic field. The experimental data obtained agreed with the theoretical. Calculations were compared with experimental data found in the literature. (tr-auth)

20871 NATURAL CONVECTION IN A STRONG MAGNETIC FIELD. Sapunkov, Ya. G. Magn. Gidrodin.; No. 4, 24-31(1974). (In Russian).

The non-self-modeling problem of natural convection of viscous heat-conducting and electrically conducting liquids in a plate in which there is an arbitrary temperature distribution was solved. The solution is given for strong magnetic fields. For internal fields a precise solution was obtained and for external, to the first three approximations, equations were constructed and limiting conditions were set. The external expansion equations were solved by an approximate integral method. (tr-auth)

20872 THERMAL VORTICITY AND VELOCITY FLUCTUATIONS IN CHANNEL FLOW. Szu, H. H.; Hermans, J. J. (North Carolina Univ., Chapel Hill). Proc. K. Ned. Akad. Wet., Ser. B.; 78: No. 1, 1-14(1975).

The spatial derivatives of the spontaneous stress fluctuations are introduced as source terms in the Navier–Stokes equations. The fluctuations in the velocity are treated as small perturbations of the average flow, and the hydrodynamic equations are linearized in these perturbations. As a first approximation, the average flow is replaced by a uniform velocity. Solutions are found which satisfy the appropriate boundary conditions at the walls of the channel and from which the correlation functions for velocities and vortices are derived. The equations used describe diffusion processes by which correlations are spread out spatially in the course of time. It is also indicated how the calculation must be modified when other boundary conditions are valid, in particular when the liquid is a free jet in the form of a flat sheet. The possible relevance to turbulent flow is briefly discussed. (NL)

20873 MAGNETOHYDRODYNAMIC TURBULENCE. Tsinober, A. B. Magn. Gidrodin.; No. 1, 7-22(1975). (In Russian).

Studies on magnetohydrodynamic turbulence of incompressible homogeneous electrical conducting fluids with $Re_m \ll 1$ are reviewed (211 references). The results of studies on integral properties of currents and the present state of those started some years ago on local properties of magnetohydrodynamic turbulence are examined. Special attention is given to two-dimensional turbulence. (tr-auth)

20874 HEAT AND MASS EXCHANGE IN A MAGNETIC FIELD. Blum, E. Ya. Magn. Gidrodin.; No. 1, 35-46(1975). (In Russian).

The question of heat and mass exchange in an electrically conducting liquid located in a magnetic field is reviewed. Heat exchange of laminar magnetohydrodynamic flows in channels and in a boundary layer and convective mass transfer in such flows are considered. Work on turbulent heat and mass exchange in a magnetic field is also reviewed. 121 references. (tr-auth)

20875 HYDRODYNAMICS OF A MAGNETIZABLE MEDIUM. Shaposhnikov, I. G.; Shliomis, M. I. Magn. Gidrodin.; No. 1, 47-58(1975). (In Russian).

The basic directions and the most important results of studies on hydrodynamics of ferromagnetic suspensions (ferrohydrodynamics) and of paramagnetic liquids are summarized briefly. (98 references) (tr-auth)

20876 MAGNETOHYDRODYNAMICS OF NON-NEWTONIAN LIQUIDS. Martinson, L. K.; Pavlov, K. B. Magn. Gidrodin.; No. 1, 59-67(1975). (In Russian).

USSR work on magnetohydrodynamics of liquids with special mechanical properties is reviewed. The effect of a magnetic field on the nature of steady and unsteady flows of conduction of nonlinear-viscous media is discussed. 47 references. (tr-auth)

20877 ELECTRICALLY CONDUCTING LIQUID IN THE INHERENT MAGNETIC FIELD OF AN ELECTRIC CURRENT. Shcherbinin, E. V. Magn. Gidrodin.; No. 1, 68-74(1975). (In Russian).

Work on the problem of the origin of flow in the passage of an electrical current in a liquid or gas is reviewed. 15 references. (tr-auth)

20878 STABILIZATION LENGTH FOR CIRCULAR AND RECTANGULAR TUBES IN A STRONG MAGNETIC FIELD. Walker, J. S. (Univ. of Illinois, Urbana); Ludford, G. S. S. Magn. Gidrodin.; No. 1, 75-78(1975). (In Russian).

The stabilization length in circular and rectangular tubes of constant cross-section in a strong magnetic field is estimated and the conditions under which the estimate is true (using the Hartman number, the magnetohydrodynamic interaction parameter, and the relative conductivity of the walls) are presented. In a rather strong magnetic field, where the inertia effects are vanishingly small, the stabilization length becomes comparable to or smaller than the typical cross dimension for all rectangular tubes and for circular tubes with a well conducting wall but remains large for circular tubes with a poorly conducting wall. 10 references. (tr-auth)

20879 REVIEW OF WORK ON DONETS SCIENTISTS ON APPLIED MAGNETOHYDRODYNAMICS. Barinberg, A. D.; Kapusta, A. B.; Chekin, B. V. Magn. Gidrodin.; No. 1, 110-117(1975). (In Russian).

The results of studies of Donets scientists on applied magnetohydrodynamics in the last ten years are presented briefly. 32 references. (tr-auth)

20880 MAGNETOHYDRODYNAMIC BOUNDARY FLOW IN THE TRANSITION FROM CROSSED-FIELDS TO ALIGNED-FIELDS. Morioka, S. (Osaka Univ., Toyonaka (Japan). Faculty of Engineering Science). J. Phys. Soc. Jap.; 37: No. 2, 552-557(Aug 1974).

The perturbation flow of a conduction ideal gas past a wedge-nosed plate is considered for infinitesimal magnetic Reynolds number and Alfven Mach number, but arbitrary interaction parameter N, magnetic field direction θ, and Mach number. The analytical solution provides the linear version corresponding to the singular behaviour of the magnetohydrodynamic boundary layer, predicted by Sears, when the flow changes from crossed-fields to aligned-fields. The factor $N^{\frac{1}{2}} \sin\theta$ has the significant implication. If it decreases less than one for a large N, the inviscid magnetohydrodynamic boundary layer grows rapidly, but if it increases for a small θ, the flow tends to be accelerated independently of N. The solution also provides the information about the nature of the magnetohydrodynamic boundary flow on the wedge section and on the following plate section, and the difference due to the Mach number. (auth)

20881 STABILITY CONDITIONS FOR CIRCULAR FLOWS OF ORDINARY FLUID AND HYDROMAGNETIC FLUID IN AXIAL MAGNETIC FIELD WITH RESPECT TO FLUTE-MODE PERTURBATIONS. Sasakura, Y. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). J. Phys. Soc. Jap.; 37: No. 2, 482-485(Aug 1974).

By extending Rayleigh's theorems a sufficient condition for instability of circular flow of an inviscid compressible fluid with respect to flute-mode perturbations is derived at a low Mach number; $(V_\theta/r)^2[r^2(\rho_0'/\rho_0) - (V_\theta/V_s)^2] + 2V_\theta(rV_\theta)'r^2 \leq 0$ throughout the flow field. For a non-dissipative compressible hydromagnetic fluid in an axial magnetic field, therefore, a sufficient instability condition for circular flow with respect to flute-mode perturbations at a low Alfvén-Mach number can be readily obtained by replacing Vs^2 in the above inequality by $V_s^2 + V_A^2$. Here $\rho_0(r)$ is the density, $V_\theta(r)$, $V_s(r)$ and $V_A(r)$ are the flow, the sound and the Alfvén speed, respectively, and the prime denotes differentiation with respect to the radial distance r. (auth)

20882 HYDROMAGNETIC FREE CONVECTIVE FLOW PAST A VERTICAL FLAT PLATE WITH VARIABLE VISCOSITY AND THERMAL CONDUCTIVITY. Jana, R. N. (Indian Inst. of Tech., Kharagpur). Jap. J. Appl. Phys.; 13: No. 9, 1443-1448(Sep 1974).

Hydromagnetic free convective flow of liquids past a heated vertical flat plate with temperature-dependent viscosity and thermal conductivity has been analysed. It is observed that with the increase of temperature the coefficient of viscosity decreases bringing an increase in the skin friction and the viscous boundary layer. The corresponding effect on thermal diffusivity is to decrease the heat transfer from the plate. (auth)

PHYSICS (HIGH-ENERGY)

Particle Interactions and Properties (Experimental)

Refer also to abstracts 20496 and 21052.

20883 (COO-3130TA-322) PROGRESS REPORT FOR A RESEARCH PROGRAM IN THEORETICAL HIGH-ENERGY PHYSICS. Feldman, D. (Brown Univ., Providence, R. I. (USA). Dept. of Physics). 1 Jun 1975. 9p. Dep. NTIS $4.00.

Last year's research program dealt with a variety of topics including eikonal/multiplicity studies (elastic and inelastic distributions by a semi-classical method, Gribov calculus); analytic parametrization (total cross sections, real to imaginary ratios of forward amplitudes, charge-exchange processes); multiperipheral cluster models (pion-pole dominance); narrow-width particles (conventional hadronic model for psi(3.1) and psi(3.7), baryon-antibaryon resonances, decays of long-lived hadrons); neutrino-nucleon collisions (charmed particles, neutral-current processes); models for permanently bound quarks (scalar quarks in one dimension, meson decays, spin-$\frac{1}{2}$ colored quarks); spontaneous symmetry breaking (excitation of composite fields, non-abelian gauge theories); properties of model field theories (Nambu model, Luttinger model); functional techniques for many-body systems (multiparticle production, phase transitions); topics in general relativity; as well as other studies involving the strong, electromagnetic, and weak interactions of elementary particles. A list of publications is included. (auth)

20884 (UCR-34P107-170) ANNUAL REPORT [ON HIGH ENERGY PHYSICS]. Kernan, A.; Poe, R. T. (California Univ., Riverside (USA)). Jun 1975. Contract AT(04-3)-34P107. 24p. Dep. NTIS $4.25.

Efforts were concentrated on streamer chamber studies of heavy-ion interactions at the Bevalac and studies of proton diffraction dissociation at the CERN ISR. After a general description of this work, the following programs are discussed individually: streamer chamber study of OMEGA and XI* states; streamer chamber study of neutral mesons; high-energy heavy-ion physics (study of fragmentation characteristics of heavy-ion collision and exploratory study of central-collision phenomena); observation of double Pomeron exchange processes at ISR energies; reports at the 1974 PEP summer study (measurement of the total cross section for e^+e^- yields hadrons, search for new particles at PEP, two-photon annihilation processes at PEP); and diffractive excitation of the proton at ISR energies. (RWR)

20885 HIGH ENERGY PHYSICS INDEX. Volume 13, No. 1-2, 1975. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1975). 90p.

20886 HIGH ENERGY PHYSICS INDEX. Volume 13, No. 6, 1975. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1975). 100p.

20887 HIGH ENERGY PHYSICS INDEX. Volume 13, No. 8, 1975. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1975). 99p.

20888 HIGH ENERGY PHYSICS INDEX. Volume 13, No. 9, 1975. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1975). 154p.

20889 HIGH ENERGY PHYSICS INDEX. Volume 13, No. 10, 1975. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1975). 111p.

20890 HIGH ENERGY PHYSICS INDEX. Volume 13, No. 11, 1975. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1975). 100p.

20891 HIGH ENERGY PHYSICS INDEX. Volume 13, No. 12, 1975. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1975). 112p.

20892 HIGH ENERGY PHYSICS INDEX. Volume 13, No. 13, 1975. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1975). 107p.

20893 KEK ANNUAL REPORT, 1973. KEK Annu. Rep. (Natl. Lab. High Energy Phys.).; No. 1973, 1-147([nd]).

Activities in the National Laboratory for High Energy Physics (KEK) for the period of April 1973 to March 1974 are described. In the KEK, construction is proceeding on the proton synchrotron, which forms the core of the laboratory; the beam energy up to 12 GeV is planned. During the year, its preinjector and linac were completed, ready for the test operation. All the main ring magnets were installed in the tunnel. KEK consists broadly of three departments; accelerator, physics, and scientific and technical service. (JA)

20894 HIGH ENERGY PHYSICS INDEX. Volume 12, No. 26, 1974. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1974). 84p.

Electromagnetic

Refer also to abstract 21077.

20895 (COO-1195-340) PHOTOPRODUCTION AT FNAL. Wattenberg, A. (Illinois Univ., Urbana (USA). Dept. of Physics). May 1975. 13p. (CONF-750547-6). Dep. NTIS $4.00.

From fourth international symposium on nucleon-antinucleon interactions; Syracuse, New York, USA (2 May 1975).

Difficulties in estimating rates for the photoproduction of $\Lambda-\Lambda$ pairs are discussed first. Then the experimental measurements are taken up; the beam and spectrum, the detecting apparatus, the results on $\gamma + Be \rightarrow X + \psi(\mu\mu)$, and some raw data on hadron production are considered. An approximate value of 1.0 mb was obtained for the total cross section of a psi particle on a nucleon. (9 figures) (RWR)

20896 (COO-1195-341) HIGH ENERGY PHOTOPRODUCTION OF NEW MASSIVE PARTICLES. O'Halloran, T.; Sarracino, J.; Wattenberg, A. (Illinois Univ., Urbana (USA)). May 1975. 14p. (CONF-750654-4). Dep. NTIS $4.00.

From international conference on high energy physics; Palermo, Italy (Jun 1975).

A series of experiments studying the high-energy photoproduction of the narrow resonance at 3.1 GeV/c^2 is discussed. The beam and detecting apparatus are described, and then the results obtained on photoproduction of the new massive particles are presented. Mass spectra of mu^+mu^- and e^+e^- pairs obtained from photons (from 300-GeV protons) on Be are shown, along with the cross section for psi(3.1) yields mu mu for a sample of clean events. (10 figures) (RWR)

20897 (DESY-74/58) POMERON FACTORISATION AND THE REACTION $\gamma N \rightarrow \varphi N$. Dass, G. V.; Fraas, H. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Dec 1974. 42p. INIS.

4 tabs.; 26 refs.

Because of the suitability of $\gamma N \rightarrow \varphi N$ for studying the Pomeron, we systematically investigate the tests for Pomeron factorization possible in this rather clean reaction, particularly with the more feasible experiment which measures the phi density matrix, and also an experiment measuring the recoil nucleon polarization; the complete set of initial polarization configurations has been considered. (GE)

20898 (TID-26967) STUDY OF PHOTOPRODUCTION OF VECTOR MESONS ON DEUTERIUM BY 5.5 GeV LINEARLY POLARIZED PHOTONS. Gupta, V. P. (California Univ., Riverside (USA)). Dec 1974. 81p. Dep. NTIS $7.25.

Thesis.

The experimental results of a deuterium bubble chamber photoproduction study of half a million pictures at 5.5 GeV are presented. This experiment was performed using a monoenergetic and linearly polarized photon beam facility at SLAC. At 5.5 GeV the beam polarization is greater than 90 percent, and the average FWHM of the beam energy spectrum is 0.6 GeV. The reaction gamma d yields pi^+pi^-d was studied in detail. A clear sample of gamma d yields rho^0d channel was obtained, and using the rho^0 decay distribution in terms of an extended density matrix which includes correlation with the beam polarization, one could determine nine independent density matrix parameters. The study of rho^0 production and decay in the reaction channel gamma d yields rho^0d was found to proceed almost completely through natural parity exchanges; the contribution from unnatural parity exchanges being only (5.3 +- 4.5) percent for momentum transfer parallel t parallel less than or equal to 0.25 GeV^2. It was observed that the rho^0 production mechanism conserves s-channel cms helicity for parallel t parallel less than or equal to 0.15 GeV^2. After carrying out the fitting to the pi^+pi^- mass distribution, one obtained for the rho^0 mass and width the values (766 +- 5) and (139 +- 11) MeV, respectively. The rho^0 production cross section in this channel was determined to be (9.1 +- 0.8) mu b. The final states $pi^+pi^-pi^0$d,

K^+K^-d, $pi^+pi^+pi^-pi^-d$, and $pi^+pi^-pi^-pp$ were obtained for the production of omega, phi, rho', and A_1 mesons, respectively. However, due to insufficient statistics, no conclusive remarks could be made. (auth)

20899 TOTAL CROSS-SECTION MEASUREMENT OF π^- PHOTOPRODUCTION ON DEUTERON IN THE FIRST-RESONANCE REGION. Chiefari, G. (Univ., Naples); Drago, E.; Napolitano, M.; Sciacca, C.; Votano, L. Lett. Nuovo Cim.; 13: No. 4, 129-133 (24 May 1975).

The total cross sections for the reactions $\gamma + d \rightarrow p + p + \pi^-$ were measured and shown as a function of E^2. Also the total cross sections for the reaction $\gamma + n \rightarrow p + \pi^-$ are calculated as a function of the same variable. It is concluded that the discrepancies still existing among the bubble chamber γn cross sections must be attributed essentially to the method used for extracting them and not to the rough experimental data. (JFP)

20900 COMPARISON OF THE $\gamma p \rightarrow \pi^-\Delta^{++}$ REACTION AT 1.7 TO 6.3 GeV WITH THE OPE-MODEL AND STUDY OF THE $\gamma p \rightarrow p\pi^+\pi^+\pi^-\pi^-$ REACTION AT 3 TO 18 GeV. Schacht, P. Munich; Technische Univ. (1973). 64p. (In German). INIS.

Thesis.

The photoproduction of hadrons at hydrogen is measured at DESY using streamer spark chambers. The experimental arrangement and the trigger system-dependent corrections are discussed. The OPE-model describes very well the differential cross sections d sigma/dt, the energy dependence of the cross section and the elements of the density matrix. A strong rho-1600 production is found above 5.5 GeV for the $\gamma p \rightarrow p\pi^+\pi^+\pi^-\pi^-$ reaction shown by maximum likelihood approximation. (GE)

20901 ETA-MESON ELECTROPRODUCTION AT THE $S_{11}(1535)$-RESONANCE. Schloesser, E. Bonn; Univ. Bonn (1973). 34p. (In German). INIS.

Thesis.

The angular distributions of the reaction $e^-p \rightarrow e^-p$ eta is measured at the 2.5 GeV Bonn-Synchrotron at the $S_{11}(1535)$-resonance and at $q^2 = -0.2$, -0.28 and -0.4 $(GeV/c)^2$. The recoil proton and the scattered electron are measured in coincidence. The pions are separated by line-of-flight and pulse-amplitude. The angular distributions measured show no deviation from isotropy. (GE)

20902 INCLUSIVE π^0-PHOTOPRODUCTION AND COMPARISON WITH HADRON AND ELECTROPRODUCTION EXPERIMENTS. Struczinski, W. Aachen; Univ. Aachen (1973). 62p. (In German). INIS.

Thesis.

The photoproduction of hadrons on hydrogen is measured at DESY from 1.65 GeV to 6.3 GeV using streamer spark chambers. The results for π^0-photoproduction are discussed in detail. (GE)

Weak

Refer also to abstract 20952.

20903 (CONF-750307-10) NEUTRINO INTERACTIONS WITH TWO MUONS IN THE FINAL STATE. Barish, B. C.; Bartlett, J. F.; Bodek, A. (California Inst. of Tech., Pasadena (USA); Fermi National Accelerator Lab., Batavia, Ill. (USA)). 9 Apr 1975. Contract AT(11-1)-68. 12p. Dep. NTIS $4.00.

From international colloquium of the CNRS on neutrino physics at high energy; Paris, France (18 Mar 1975).

Neutrino interactions with two muons in the final state have been observed in the Caltech-Fermilab neutrino experiment. At the approximately 1 percent level nutrino events are observed to have an "extra" muon. Calculations for the decays of pi and K mesons in the hadron final state give numbers which make this mechanism for the signal unlikely. (7 figures, 1 table) (auth)

Strong (Baryon-induced)

Refer also to abstracts 21082 and 21090.

20904 (CONF-750649-1) ACCELERATION OF POLARIZED PROTONS TO MULTI-GeV ENERGIES AND EXPERIMENTS WITH POLARIZED PROTONS FROM 2 TO 6 GeV/c. Ratner, L. G. (Argonne National Lab., Ill. (USA)). 1975. 51p. Dep. NTIS $5.75.

From symposium on hadron physics at high energies; Liblice, Czechoslovakia (16 Jun 1975).

Work with polarized protons at the ANL Zero Gradient Synchrotron is reviewed. The 6 GeV/c beam has achieved 6×10^9 polarized protons per pulse with 73 percent polarization. After a few remarks about machine operation, most of the results obtained by use of this beam are presented. The following experiments are included: proton-proton total cross sections; two and three spin measurements (simultaneous measurement of 2 and 3 spin interactions; measurement of C/sub NN/ at 3, 4, 6 GeV/c; measurement of D/sub NN/, D/sub SS/, and H/sub NSP/ at 6 GeV/c; measurement of D/sub NN/ at 6 GeV/c); polarization measurements in nucleon-nucleon elastic scattering (small-angle polarization in elastic pp scattering; np and pp polarization at 2, 3, 4, 6 GeV/c); inelastic interactions (N* and DELTA production in the effective mass spectrometer); inclusive LAMBDA production (effective mass spectrometer experiment; exposure in the 12-ft hydrogen bubble chamber); coherent polarized proton-^{4}He interactions; and parity tests. (26 figures) (RWR)

20905 (COO-1195-339) HADRON PRODUCTION AT 0.8 MRAD BY 300 GeV PROTONS INCIDENT ON A THICK ALUMINUM TARGET. Aubert, B.; Benvenuti, A.; Cline, D. (Fermi National Accelerator Lab., Batavia, Ill. (USA)). Apr 1975. 3p. (CONF-750307-8). Dep. NTIS $4.00.

From international colloquium of the CNRS on neutrino physics at high energy; Paris, France (18 Mar 1975).

Hadron ($\pi^\pm$, $K^\pm$, p, $\bar{p}$) production was measured by using the Fermilab muon beam as a double-bend spectrometer, with the addition of threshold Cherenkov counters for particle identification. The measurement was made at 0.8 mrad with 300-GeV protons incident on a thick aluminum target. (auth)

20906 (COO-3130TB-214) PROGRESS REPORT OF A RESEARCH PROGRAM IN EXPERIMENTAL HIGH ENERGY PHYSICS, 1 SEPTEMBER 1974--31 AUGUST 1975. Shapiro, A. M.; Lanou, R. E. Jr. (Brown Univ., Providence, R. I. (USA)). 1975. Contract E(11-1)-3130. 59p. Dep. NTIS $6.00.

An experimental program in strong interaction physics is carried out using bubble chamber-hybrid system and counter-spark chamber techniques. The experiments were and are being performed utilizing the accelerators of the National Laboratories at Argonne, Brookhaven, and Batavia. In 4.1-GeV/c pi^+p interactions, the bubble chamber group is studying: pi^+ and pi^- inclusive distributions; two-particle correlations; two-body and quasi-two-body production mechanisms; and strange-particle production. A multiwire proportional hybrid system was brought into operation at FNAL. With it, aspects of 150-GeV/c pi^-p, pi^+p, and pp interactions are studied: total and partial cross sections; charged-particle multiplicity distributions and their moments; single-particle inclusive distributions and two-particle correlations; leading particle and diffraction phenomena; and production models for high multiplicity events. The experiments of the counter-spark chamber group include the following: a study of baryon exchange processes using backward pion charge exchange; a search for high mass boson resonances and the determination of their quantum numbers in antiproton-proton systems; a nucleon-nucleon and meson-nucleon elastic and quasi-elastic scattering experiment at the highest accelerator energies possible; protons, pions and kaons are used as projectiles and protons and neutrons as targets; the role of the pomeron and exchange models generally is investigated; and a measurement of the inclusive spectra of hadrons as a function of multiplicity at FNAL energies. (auth)

20907 (COO-3230-4) RESEARCH IN ELEMENTARY PARTICLE PHYSICS. Technical Progress Report, 1 September 1974--29 May 1975. Kirsch, L. E.; Schnitzer, H. J. (Brandeis Univ., Waltham, Mass. (USA). Dept. of Physics). 1975. Contract E(11-1)-3230. 15p. Dep. NTIS $4.00.

Experimental and theoretical research on strong interactions is summarized. A list of publications is included. (JFP)

20908 (LBL-3636) AN EXPERIMENTAL STUDY OF THE REACTION $p + d$ YIELDS $^3He + pi^0$ IN THE DELTA(1236) RESONANCE REGION. Fredrickson, D. H. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Aug 1974. Contract W-7405-ENG-48. 99p. Dep. NTIS $8.00.

Thesis.

The differential cross section of the reaction $p + d$ yields $^3He + pi^0$ was measured at an incident proton energy of 462 MeV for ^3He cm angles between 50 and 130°. Limited angular distributions were also obtained at 377 and 576 MeV. The ^3He particle momentum was measured by using wire spark chambers in conjunction with a total energy absorption scintillation counter. A decay photon from the pi^0 was detected in a lead glass Cherenkov counter. The results are discussed in terms of a two-nucleon model and a OPE model of the reaction. The cross section at 462 MeV is also compared with that of its isospin conjugate reaction, $p + d$ yields $^3H + pi^+$, and agreement with the principle of isospin invariance is satisfactory, except at small pion angles. (auth)

20909 (LBL-3859) PION PRODUCTION IN NUCLEUS-NUCLEUS COLLISIONS. Schroeder, L. S. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1975. Contract W-7405-ENG-48. 11p. (CONF-750631-12). Dep. NTIS $4.00.

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975).

Current work on pion production in high-energy nucleus-nucleus collisions is reviewed. The majority of existing data are of the inclusive variety in which a single final state pion is detected. Experimental data are compared and their possible contributions to obtaining new information on nuclear structure is discussed. Various models which attempt to explain the observed single-inclusive-pion spectra either on the basis of a nucleon-nucleus interaction in which Fermi motion is included or on some type of cooperative model are examined. Other areas of interest involving pion production include tests of charge symmetry and pion multiplicities. (9 figures, 1 table) (auth)

20910 (ORO-4449-6) STUDY OF THE NEUTRON–PROTON INTERACTION IN THE 300-700 MeV ENERGY REGION. Annual Progress Report, 1974–1975. Northcliffe, L. C. (Texas Agricultural and Mechanical Univ., College Station (USA). Research Foundation). 24 Jul 1975. Contract AT(40-1)-4449. 12p. Dep. NTIS $4.00.

During the past year the LAMPF user group from Texas A and M University worked with scientists from LASL, the University of Texas, and the University of New Mexico to study neutron-producing reactions, the n–p differential cross section for charge-exchange scattering, meson production in nucleon–nucleon collisions, and spectra of charged particles produced in the bombardment of various targets by monoenergetic neutrons. This report encompasses personnel, experimental method and apparatus, and results. The research is discussed briefly, and reference is made to appropriate places in the literature where more details can be found. (RWR)

20911 (UCR-34PA107-196) PRELIMINARY RESULTS OF CHARM SEARCH. Baum, L.; Block, M.; Crawford, J.; Couchman, B.; Derevshchikov, A.; Golutvin, I.; Hilsher, H.; Irion, J.; Kernan, A.; Kukhtin, V.; Layter, J.; Marsh, W.; Muller, F.; McIntire, P.; Naroska, B.; Nussabaum, M.; Orkin-Lecourtois, A.; Rossi, L.; Rubbia, C.; Schinzel, D.; Shen, B.; Staude, A.; Tarnopolski, G.; Voss, R. (European Organization for Nuclear Research, Geneva (Switzerland)). 17 Apr 1975. 6p. Dep. NTIS $4.00.

The electron to pion ratio at 30^0 from pp collisions has been measured at the ISR (26 GeV on 26 GeV). Preliminary results are presented. (auth)

20912 ENERGY SPECTRUM OF SURVIVING PRIMARY PROTONS WITH ENERGIES (3/30) TeV AT 5200 M A.S.L. AND THE CROSS SECTION FOR PROTON–AIR-NUCLEUS COLLISIONS. Aguirre, C. (Universidad Mayor de San Andres, La Paz, Argentina); Treep, A.; Mejia, G. R. Nuovo Cim.; 27B: No. 2, 263-282 (11 Jun 1975).

The energy spectrum of surviving primary cosmic-ray protons without collision in the atmosphere was obtained from the observation of high energy nuclear bursts produced by singly charged particles in the energy range 3 to 30 TeV without accompanying air shower particles at Chacaltaya, Bolivia (5200 m a.s.l. or 550 gcm^{-2} atmospheric depth). Comparison of this spectrum with an extrapolation of the energy spectrum of primary cosmic-ray protons obtained by Ryan et al. to higher energies with the same exponent shows a logarithmic rise of the cross section for proton–air-nucleus collisions from 3 to 9 TeV. (auth)

20913 DISTRIBUTION OF SHOWER PARTICLES AS OBTAINED IN THE ANALYSIS OF A 10 + 13p SHOWER EVENT. Bandyopadhyay, B. K.; Daftari, I. K.; Roy, T. (Jadavpur Univ., Calcutta). Ann. Phys. (Leipzig); 31: No. 2, 120-124(Jun 1974).

The analysis of an accelerator produced 10 + 13p shower event observed in nuclear emulsion is presented. The Duller-Walker method is applied to obtain the distribution of secondary shower particles, and the particles having the closest $\log_{10} \tan \Theta_L$ values are taken to form a cluster. This cluster formation is also confirmed by the target diagram method. If this cluster is conceived to be a high spin resonance and the secondary pions to be the decay products of this resonance, then the azimuthal integral distribution curve fits fairly well with our experimental data. (3 figures, 1 table) (auth)

Strong (Meson-induced)

Refer also to abstract 19819.

20914 (COO-1195-343) POSSIBLE BROAD 3π RESONANCE NEAR 1900 MeV/C COUPLING TO $N\bar{\Delta}$. Rhines, D. S. (Illinois Univ., Urbana (USA). Dept. of Physics). May 1975. 4p. (CONF-750547-5). Dep. NTIS $4.00.

From 4th international symposium on nucleon–antinucleon interactions; Syracuse, New York, USA (2 May 1975).

Work on the possible existence of narrow enhancements (~10 MeV or less) in the $\bar{N}$–N total cross section near threshold was considered at this conference. Recently published data on the interaction $\pi^- p \to p\pi^+\pi^-\pi^-$ are shown; numbers of events are plotted vs $m(\pi^+\pi^-\pi^-)$. A broad enhancement was seen in the 1900-MeV region; a fit to a smooth background plus a Breit–Wigner enhancement gave $M = 1895 \pm 19$ MeV/c^2 with a width of 123 ± 66 MeV/c^2. A few brief comments on the data are made. (3 figures) (RWR)

20915 (JINR-D1-8859) CHARGE DISTRIBUTIONS IN π^-p AND π^-n INTERACTIONS AT 40 GeV/c. Kladnitskaya, E. N.; Mel'nikova, N. N.; Mihul, A.; Shekhter, V. M.; Shcheglova, L. M. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 30p. Dep. NTIS (US Sales Only) $4.50.

Charge distributions in π^-p and π^-n interactions are studied at 40 GeV/c. The inclusive c.m.s. distributions of the charge of the incoming particles are broad, extending throughout the central region. Most of the electric charge of the incoming hadrons concentrates in the range of small values of $x(|x| \leq 0.2)$. The average charge per charged hadron slightly depends on y and is equal to about 0.1 in the central region. These results are compared with the predictions of the multiperipheral model as well as the quark model. (13 figures) (auth)

20916 (JINR-P1-8718) STUDY OF PARTIAL INELASTICITY COEFFICIENTS IN π^-p, π^-n, AND π^-C^{12}-INTERACTIONS AT 40 GeV/c. Angelov, N. S.; Grishin, V. G.; Didenko, L. A. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 21p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

The average fraction of energy in the lab system put into π^0 mesons (α_{π^0}) in π^-p, π^-n, and π^-C^{12} interactions at 40 GeV/c is determined. The obtained values are 0.25 ± 0.01, 0.28 ± 0.02, and 0.25 ± 0.01, respectively, thus being independent of the target mass within the errors. The decrease of α_{π^0} with the rise of charged multiplicity in π^-p and π^-n interactions is observed. The dependence of the average fraction of energy (in the lab system) put into charged secondaries in π^-p and π^-n interactions as a function of charged multiplicity is also considered. The investigation has been performed at the Laboratory of High Energies, JINR. (4 figures, 6 tables) (auth)

20917 (JINR-P1-8848) ANALYSIS OF SEMI-INCLUSIVE ONE-PARTICLE DISTRIBUTIONS IN π^-p INTERACTIONS AT P = 40 GeV/c. Abesalashvili, L. N.; Amaglobeli, N. S.; Grishin, V. G. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 24p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

Basing on the studies of 6000 π^-p interactions one-particle semi-inclusive π^+-meson spectra were analysed using the diffraction excitation model. (3 tables, 11 figures) (auth)

20918 (ORNL-5025, pp 81-82) $pi^+ + d$ yields p + p AT 40, 50, AND 60 MeV. Gross, E. E.; Ludemann, C. A.; Saltmarsh, M. J. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

Angular distributions have been obtained for the $pi^+ + d$ yields p + p reaction at incident pion energies of 40, 50, and 60 MeV. Measurements were made over the angular range from 15 to 110 degrees with a statistical accuracy of 3 percent. (1 figure) (SDF)

20919 (ORNL-5025, pp 220-221) pi^--HYDROGEN AT VERY HIGH ENERGIES. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

Experiments involving the interaction of 147 GeV/c pi^- with hydrogen have been performed. Data was obtained at FNAL with the 30 inch bubble chamber and wire proportional counter hybrid system. Topological cross sections are given. (1 table) (SDF)

20920 (TID-26968) DECAY OF A_2^0 IN THE STREAMER CHAMBER. Ozawa, J. T. (California Univ., Riverside (USA)). Jun 1975. 132p. Dep. NTIS $9.75.

Thesis.

The neutral A_2^0 meson was studied in the reaction $\pi^-p \to A_2^0 n$ at 3.2 GeV/c. Using the missing mass technique, the neutron triggered the streamer chamber at Lawrence Berkeley Laboratory to detect the decay products of A_2^0. The neutrons were detected by a neutron spectrometer system consisting of 30 scintillation counters in the Jacobian peak area and 20 scintillation counters in the forward direction. A result consistent with the nonsplitting of A_2^0 (1320) is found. (auth)

20921 MASS SPECTRUM IN THE Q-REGION OF STRANGE MESONS PRODUCED IN π^-–p COLLISIONS AT 6.15 GeV/c. Dore, U. (Univ., Rome); Guidoni, P.; Laakso, I.; Marini, G. Lett. Nuovo Cim.; 13: No. 7, 265-268(14 Jun 1975).

The mass spectrum of X^0, where X^0 = neutrals, was studied in the interaction $\pi^- + p \to \Lambda + X^0$, $\Lambda \to \pi^- + p$. The mass spectrum

is analyzed in the region below 1600 MeV and described in terms of the K(1420) only. (JFP)

20922 STUDY OF π DISSOCIATION TO $(\pi^+\pi^+\pi^-)$-SYSTEMS IN THE A_3-RANGE IN THE REACTIONS $\pi^+p \to (3\pi)^+p$ AND $\pi^+p \to (3\pi)^+(N\pi)^+$ OF TWO π^+p SCATTERING EXPERIMENTS AT 16 GeV/c LAB. Rost, M. Bonn; Univ. Bonn (1972). 85p. (In German). INIS.

Thesis.

The data considered are found to indicate a d sigma/dt' slope compatible with those of elastic scattering, an isospin-zero exchange, the expected factorization properties, $(3\pi)^+$ systems with the same spin-parity composition in diffractive single and double dissociation reactions as shown by D moment analysis. (GE)

Particle Interactions and Properties (Theoretical)

20923 (JINR-P2-8880) CALCULATION OF THE DIFFERENTIAL AND TOTAL CROSS SECTIONS IN THE GLAUBER APPROXIMATION. Eliseev, S. M. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 23p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

Different ways of calculating differential elastic and total cross sections on the basis of the Glauber approxtmation are considered. The corresponding programs in FORTRAN are presented as well as complete instructions for users. The nuclear wave functions can be set in an analytical form and in a tabulated form. The program can be used for calculation in a high-energy approximation. (auth)

20924 RELATION BETWEEN THE INTERNAL-CLUSTER MULTIPLICITY DISTRIBUTION AND THE SEMI-INCLUSIVE CORRELATION FUNCTIONS. Gien, T. T. (Memorial Univ. of Newfoundland, St. John's). Lett. Nuovo Cim.; 13: No. 5, 193-199(31 May 1975).

It is found that it is too heuristic to conclude that the behavior of the n-dependence of A_0 (where A_0 is in general a function of n and its n-dependence reflects directly the structure of the internal cluster multiplicity distribution) can definitely lead one to know the characteristic of the internal-cluster multiplicity distribution. (JFP)

20925 NEUTRAL CURRENTS, ADLER SUM RULES, AND THREE-TRIPLET MODEL. Katuya, M. (Hokkaido Univ., Sapporo). 13: No. 7, 259-264(14 Jun 1975).

It is known that in the quark model that the neutral currents obtained from the closed weak-charge hypothesis are in contradiction to the observed neutral currents, i.e., the absence of $\Delta Y = 1$ neutral currents. But it is pointed out how this problem may be avoided in the three-triplet model. The neutral current magnitudes are given in terms of the integrals of the deep inelastic structure functions. Lastly some conditions are proposed which are to be imposed on the hadronic weak currents based on the three-triplet model. (JFP)

General

Refer also to abstracts 20883, 20885–20892, 20894, 21008, and 21412.

20926 (CNRS-CPT-74-P-664) MULTICOMPONENT FINITE ENERGY SUM RULES FROM DIRICHLET SERIES. Mandelbrojt, J. (Centre National de la Recherche Scientifique, 13- Marseille (France). Centre de Physique Theorique). Nov 1974. 14p. INIS.

Denoting by a "family" of Regge trajectories a mother trajectory and its daughters and any trajectory which is exchange degenerate with one of them, it is shown that the finite energy sum rules for an amplitude can be split up into as many finite energy sum rules as there are families of trajectories. Multicomponent FESR are obtained. It is shown that a resonance of A corresponds to a single family of Regge poles, so that a correspondence can be established between resonances and families of trajectories. The resonance approximation in the multicomponent FESR then leads to a new duality. (FR)

20927 (DESY-75/15) BROKEN SU(4) RELATIONS FOR PARTICLE PRODUCTION AT LARGE ANGLE. Inami, T. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Jun 1975. 30p. Dep. NTIS (US Sales Only) $4.50.

It is pointed out that inclusive distributions of π, K and η at large angles have the same dependence on transverse mass ($m_\perp$) in a wide range of $m_\perp$ at ISR energy. K/π and η/π ratios for the same value of $m_\perp$ are consistent with broken SU(3) relations derived from the tensor-dominated pomeron scheme. This idea is extended to SU(4) to derive asymptotic relations between inclusive distributions of charmed particles and noncharmed particles. From these relations $d\sigma(pp \to D^+X)/dy$ and $d\sigma(pp \to \rho_c X)/dy$ are estimated to be of the order of 1 to 5 μb and 10 to 100 nb, respectively. The consequences of sizable cross sections for production of charmed particles is discussed in connection with lepton production at large angle in hadron–hadron scattering. (5 figures, 1 table) (auth)

20928 (JINR-P2-8815) ISOTOPIC INVARIANCE AND RELATIONS BETWEEN THE CROSS SECTION OF REACTIONS WITH THE MULTIPARTICLE PRODUCTION. Beshtoev, Kh. M.; Sisakyan, A. N. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 19p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

An attempt was made, using the isotopic (SU_2) invariance, to obtain the relations between the cross sections of various reactions in the case of interactions with the multiparticle production of hadrons. The case of processes with a leading particle is considered. The investigation was performed at the Laboratory of Theoretical Physics, JINR. (auth)

20929 TRANSVERSE-MOMENTUM CORRELATION IN MULTIPERIPHERAL CLUSTER MODELS. Matsumoto, Y.; Takagi, F. (Dalhousie Univ., Halifax, Nova Scotia). Lett. Nuovo Cim.; 13: No. 6, 232-236(7 Jun 1975).

It is shown that within the framework of the multiperipheral cluster models that the transverse-momentum correlation provides further useful information on the nature of clusters. A process in which n charged particles are produced is considered. (JFP)

20930 DOES THE RECENTLY DISCOVERED PARTICLE PSI(3105) IMPLY HAN–NAMBU MODEL. Koca, M. (Middle East Tech. Univ., Ankara); Aydin, Z. Z. Lett. Nuovo Cim.; 13: No. 4, 153-157(24 May 1975).

Using $\Gamma(\psi \to e^+e^-) \leq 43$ keV and $m_\psi = 3.1$ GeV as inputs, the mass of the charmed octet was determined as compatible with those of Han–Nambu's results, and this was obtained using different considerations. (JFP)

20931 MODIFICATION OF THE DASHEN–GELL-MANN–FUBINI SUM RULE DUE TO QUARK STRUCTURE. Zerbini, S. (Univ., Bologna). Lett. Nuovo Cim.; 13: No. 4, 149-152 (24 May 1975).

A possible modification of the Dashen–Gell-Mann–Fubini sum rule and relative consequences due to parton–quark structure are discussed. The spin-averaged forward-scattering amplitude of a current mass $-q^2$ off a nucleon target of four momentum p_μ is considered. (JFP)

20932 BOOTSTRAP AND FIREBALL DISTRIBUTIONS. Lemke, H. (Karl-Marx Univ., Leipzig). Ann. Phys. (Leipzig); 31: No. 3, 287-292(Sep 1974). (In German).

It is assumed that in an inelastic collision of two particles at high energy fireballs are created, the decay of which produces the observed particles. The fireball distribution results from the decay of the primary hadron system into a leading fireball and a rest system, which can decay further. The decay is assumed to behave according to a bootstrap condition, making the fireball distribution, that results from the rest system in its rest frame, equal to the fireball distribution in the total collision in the c.m. frame. This bootstrap condition leads to an integral equation. Approximate solutions of this integral equation in the scaling limit are discussed. (2 figures) (auth)

20933 AN ANALYTIC CONTINUATION OF PROPAGATORS IN A PARTICLE-EXCHANGE MODEL. Kobayashi, M.; Mori, Y. (Gifu Univ. (Japan). Dept. of Physics). Progr. Theor. Phys. (Kyoto); 52: No. 1, 275-289(Jul 1974).

From the viewpoint that information on the behavior of a desirable propagator at $p_\mu = 0$ is provided in the analysis of kinematical singularities at $p_\mu = 0$, we examine an analytic continuation of the conventional propagator under the assumption that the tracelessness property together with the symmetry property survives even in the presence of interactions. By using the propagator thus obtained, we can construct the Lorentz poles in the Van Hove model. We obtain full amplitude as a closed form summed over all the partial waves. This follows from the decomposition of the propagator to lower spin states by using orthogonal projection operators. The unitarized propagator has the correct O(4) structure at the symmetry point when certain restrictions are imposed on the self-energy parts and yields families of J-plane poles which move with energy. Calculations on the self-energy parts in a model-dependent manner suggest that it is unlikely that daughter trajectories are parallel to the parent trajectory. (auth)

20934 A GREEN'S FUNCTION METHOD FOR CREMMER AND GERVAIS' VERTEX. Minami, M. (Kyoto Univ. (Japan). Research Inst. for Mathematical Sciences). Progr. Theor. Phys. (Kyoto); 52: No. 6, 1890-1901(Dec 1974).

It is pointed out that Cremmer and Gervais' version of the three-string vertex can be derived as a limit of a path-integral already familiar in dual-resonance theory. The basic language which will figure in this paper is the harmonic dual-position vector (stream function) over a two-dimensional domain, so that the proof is carried out within the framework of the Dirichlet problem. The vertex for large proper-time is also discussed from the same point of view. (auth)

20935 ALL-ANGEL FEATURES OF URBARYON REARRANGEMENT AMPLITUDES AND TWO-STEP STRUCTURE OF CONSTRUCTIVE FORCES. Igarashi, Y.; Matsuoka, T.; Sawada, S. (Nagoya Univ. (Japan). Dept. of Physics). Progr. Theor. Phys. (Kyoto); 52: No. 3, 986-999(Sep 1974).

An urbaryon picture having the two-step structure of the constructive forces is proposed. The very strong constructive force of the first kind works among the urbaryons q with large mass and charm charge. By the effect of urbaryon pairs q anti q in the non-charm state, the urbaryons behave as clusters Q whose effective masses are very light. The rather weak constructive force of the second kind distinguishes hadron states Q anti Q, QQQ from exotic ones, QQ anti Q anti Q, QQQQ anti Q, etc., and plays an essential role in the hadronic reactions. In the process with a large momentum transfer, the urbaryons Q are rearranged as if they were independent free particles. On the basis of this picture, it is shown that the factorizability of urbaryon rearrangement amplitude can be realized. (auth)

Electromagnetic

Refer also to abstracts 20679, 20897, and 21017.

20936 (JINR-E2-8869) LOW-ENERGY PHYSICS OF MESONS IN THE QUANTUM CHIRAL THEORY. Volkov, M. K. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 47p. Dep. NTIS (US Sales Only) $5.50.

The weak, electromagnetic, and strong interactions of pions and kaons at low energies ($\sqrt{q^2} < 1$ GeV) are described within the chiral quantum field theory. (auth)

20937 EVIDENCE FOR A J = 0 FIXED POLE AND KRONECKER-DELTA SINGULARITY IN PION COMPTON SCATTERING. Pancheri-Srivastava, G.; Srivastava, Y. N. (CNEN, Frascati, Italy). Lett. Nuovo Cim.; 13: No. 6, 221-226(7 Jun 1975).

Some theoretical reasons and indirect phenomenological evidence are presented for the presence of non-Regge singularities (fixed poles and Kronecker-delta terms) in pion Compton scattering. On the basis of some old and newly derived sum rules, the existence of a J = 0 fixed pole in the nonsense channel and a Kronecker-delta singularity at J = 0 in the sense channel are claimed for pion Compton scattering. Also both these singularities are found to be dual to the Born terms. (JFP)

20938 INCLUSIVE PRODUCTION OF PSI-PARTICLES IN pp COLLISION AND SCALING LAW. Hayashi, H. (Shizouka Univ., Japan); Iwao, S. Lett. Nuovo Cim.; 13: No. 4, 158-162 (24 May 1975).

It is shown that the appropriate treatment of the scaling law may admit one to explain both energy dependence and relative production rates of Ψ particles. If the Ψ particles are produced strongly in pair and decay electromagnetically (and weakly) to known hadrons, it gives a severe restriction to the various models proposed on Ψ particles. This point is discussed in connection with all information available at the present. The scaling law for inclusive interactions is discussed. (JFP)

20939 DIFFRACTIVE PHOTOPRODUCTION AND ELECTROPRODUCTION OF THE ψ's. Gounaris, G. J.; Verganelakis, A. (CERN, Geneva). 13: No. 7, 241-246(14 Jun 1975).

Cross sections for electro- and photoproduction of the various ϕ resonances are estimated using generalized vector dominance. The results differ considerably from those expected in the color octet interpretation. It is noted that the cross sections are mainly transverse. (JFP)

20940 ANOMALOUS MAGNETIC MOMENT OF THE ELECTRON FROM A SELF-CONSISTENT THEORY OF ELECTRODYNAMICS. Sachs, M. (State Univ. of New York, Buffalo). Lett. Nuovo Cim.; 13: No. 5, 169-172(31 May 1975).

It was previously found that, due to a background gas of electron-positron pairs in their ground states of null energy and momentum, that the magnetic moment of the observed electron embedded in such a physical vacuum would not be equal to the Dirac value. This is because an externally applied magnetic field would induce a small diamagnetic contribution that would in turn add to the free electron moment. To determine the magnitude of this effect, the quantum mechanical limit of this nonlinear theory is considered using the Hamiltonian for the magnetic energy of an electron in an external magnetic field. (JFP)

20941 DIRAC-LIKE EQUATION FOR THE PHOTON. Edmonds, J. D. Jr. (Claremont Coll., CA). Lett. Nuovo Cim.; 13: No. 5, 185-186(31 May 1975).

The photon wave equation was previously discussed in terms of 3-by-3 complex matrices. It is shown that an even more Dirac-like representation can be given, using 4-by-4 matrices in a very natural way. (JFP)

20942 S-MATRIX THEORY OF WEAK INTERACTIONS AND THE PHOTON-PHOTON PROCESSES $\gamma + \gamma \rightarrow \nu +$ ANTI ν. Abak, M. (Univ. of Sussex, Brighton, Eng.). Lett. Nuovo Cim.; 13: No. 2, 49-54(10 May 1975).

Using a previously proposed S-matrix theory approach to weak interactions, the cross section and energy loss rate are calculated for the photon-photon process. (JFP)

20943 VECTOR-GLUON DOMINANCE AND RISING DRELL RATIO FOR e^-e^+ ANNIHILATION. Krolikowski, W. (Trier-Kaiserslautern Univ., Ger.). Nuovo Cim.; 27A: No. 2, 194-202 (21 May 1975).

It is conjectured that the photon has a colored part which is dominated by colored vector gluons. The experimental rise of the Drell ratio for e^-e^+ annihilation, from D = 2 to 3 at $q^2 = 9$ $(GeV)^2$ to D = 4 to 7 at $q^2 = 25$ $(GeV)^2$, is neatly explained and, at the same time, the agreement with experimental scaling for electroproduction not much spoilt. The hypothesis predicts a further rise of the Drell ratio from D = 4 to 7 at $q^2 = 25$ $(GeV)^2$ to a maximum at $q^2 \simeq$ (40 to 50) $(GeV)^2$ and then its fall-off to the asymptotic value D = 13, preceded by a jump at $q^2 \simeq$ (160 to) $(GeV)^2$ due to the opening of the two-gluon production channel (which causes the asymptotic value to be different from D = 4). (auth)

20944 DECAY ANGULAR DISTRIBUTION OF A VECTOR-MESON PRODUCED BY POLARIZED LEPTONS IN THE QUARK MODEL. Hayashi, M.; Katsuura, K. (Saitama Medical Coll. (Japan). Dept of Physics). Progr. Theor. Phys. (Kyoto); 52: No. 1, 259-266(Jul 1974).

Assuming that a vector-meson leptoproduction proceeds through one-photon exchange, we investigate the decay angular distribution of the vector-meson produced by polarized leptons in the framework of the quark model. A number of constraints are derived among the spin density matrix elements of the vector-meson. It is shown that all the spin density matrix elements of the vector-meson produced by polarized leptons are related to those measurable in the corresponding real photoproduction and the ratio of the cross-sections of the vector-meson produced by longitudinally and transversely polarized photons. Out of 26 observable spin density matrix elements only five are independent in the quark model. (auth)

20945 ON THE RESIDUE OF J = 0 FIXED POLE AND REGGE RESIDUES IN DEEP INELASTIC e-p SCATTERING. Biyajima, M. (Osaka Univ., Toyonaka (Japan). Faculty of Engineering Science). Progr. Theor. Phys. (Kyoto); 52: No. 1, 230-239(Jul 1974).

A variety of discussion concerning the residue of J = 0 fixed poles ($R_F(q^2)$) is summarized. When the Breidenbach-Kuti fits to both resonances and Regge poles are utilized, the following result is derived: The obtained $R_F(q^2 \leq 0.5(GeV/c)^2)$ is significantly different from the analysis of the Kyoto group. From this result, we can deny that (i) Pham's conjecture $R_F(0.1) = 0$ holds and (ii) Testa's relation between $R_F(q^2)$ and Regge pole residues holds for $q^2 \leq 1.5(GeV/c)^2$. Furthermore, when we use $\omega_R = 2M\nu/(q^2 + \mu^2)$ and a large cutoff ($\nu_m = 3$ GeV), it is shown that the peculiar behavior in the Pomeron residue obtained by the Kyoto group does disappear. (auth)

Weak

20946 (IC-74-99) THE DELTA I EQUALS ½ RULE IN THE PC CONSERVING NON-LEPTONIC WEAK INTERACTIONS. Becherrawy, T. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1974. 18p. INIS.

The question of the DELTA I equals ½ selection rule in weak non-leptonic decays is studied. It is assumed that the weak amplitudes of the form (alpha parallel k/sub w/ parallel 0) obey the unsubtracted dispersion relations in the momentum transfer variable s equals (p/sub alpha/)^2 and that they obey Hoelder's condition in s except at the possible poles. Using unitarity, the determination of the weak amplitudes is transformed into solving a Hilbert problem. This in turn is transformed into a system of

Fredholm's integral equations. The number of solutions is discussed, and the solution which satisfies assumptions is found to be unique and can be expressed in terms of the strong interaction S-matrix elements. Weak amplitudes which possess a pole, namely the PC-conserving parity violating DELTA I equals ½ interactions (poles K_0 and anti K_0) and the parity-conserving DELTA I equals ½ interactions (poles K_0 and anti K_0), are shown to be consistent with these assumptions. The other DELTA I amplitudes either vanish or do not satisfy unsubtracted dispersion relations. (INIS)

20947 (LBL-4207) NEGATIVE MUON SPIN ROTATION EXPERIMENT. Yamazaki, T.; Nagamine, K.; Nagamiya, S.; Hashimoto, O. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1975. Contract W-7405-ENG-48. 12p. (CONF-750631-9). Dep. NTIS $4.00.

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975).

Results of the experimental project using negative muon spin rotation at Lawrence Berkeley Laboratory are reported. The following were discussed briefly: the bound muon g factors from the viewpoints of the relativistic and nuclear polarization effects, strange depolarization phenomena in terms of the difference between the muonic-atom probe and its equivalent nuclear probe, application of the mu⁻0 probe to studies of magnetic oxides, and total muon capture rates in the actinide region. (auth)

20948 (UH-511-197-75) SPACE TIME STRUCTURE OF NEUTRAL CURRENT. Pakvasa, S. (Hawaii Univ., Honolulu (USA) Dept. of Physics and Astronomy). Jun 1975. Contract AT(04-3)-511. 8p. Dep. NTIS $4.00.

Some work on the general phenomenological analysis of the inclusive process nu(anti nu) + N yields nu(anti nu) + anything taking all the covariants V, A, S, P, and T into account is presented. (JFP)

20949 ORDINARY SPIN CONSIDERED AS WEAK ISOSPIN IN (WEAK) LEPTONIC AND SEMI-LEPTONIC INTERACTIONS. Zlino, G. (Univ., Palermo, Italy). Lett. Nuovo Cim.; 13: No. 3, 95-103(17 May 1975).

The main lines of a new symmetry model for weak leptonic interactions is drawn based on the idea that the spin in the dynamics of such processes plays the role of a new kind of isotopic spin or weak isospin. (JFP)

20950 ARE THESE GOLDSTONE NEUTRINOS. Das, A. (Visva-Bharati Univ., West Bengal, India). Lett. Nuovo Cim.; 13: No. 7, 251-254(14 Jun 1975).

Arguments are given showing that the very existence of Goldstone neutrinos involves some unavoidable theoretical difficulties. It is found not to be possible to construct an action using the hypothesis that the neutrino is a Goldstone particle. (JFP)

20951 MASSES OF NEUTRINO, W-BOSON, AND PARAMETERS OF THE $\mu \rightarrow e\nu$ ANTI ν DECAY SPECTRUM. Barannik, V. P.; Rekalo, A. P. (Physical-Technical Inst., Kharkov). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 2, 304-309(Feb 1975). (In Russian).

The decay $\mu \rightarrow e\nu$ anti ν is considered in the framework of the weak (V, A) interaction mediated by a charged vector W-boson on the condition of the non-zero mass of the muon neutrino. The experimental data on the parameters of the isotropic and anisotropic parts of the electron spectrum are analyzed by means of a general expression for the electron spectrum in the $\mu \rightarrow e\nu$ anti ν decay. The electron spectrum is normalized. As a result, the essential restrictions for the mass of the muon neutrino ($m_\nu < 0.3$ to 0.5 MeV) and variants of the weak interaction are obtained. (2 figures) (auth)

20952 PROBING THE WEAK FORCE WITH NEUTRINOS. Cline, D. B. (Univ. of Wisconsin, Madison); Mann, A. K.; Rubbia, C. Phys. Today; 28: No. 3, vp(Mar 1975).

A review of the status of current research into the nature of the weak force using neutrinos as probes is presented. Mention is made of experimental results and their relation to proposed models. Topics include charged and neutral weak currents, maximal parity violation, and the search for new particles at high energies. Comments are offered on the direction of future study. (7 figures) (SDF)

Strong (General)

Refer also to abstracts 20907 and 21333.

20953 (CERN-Trans-74-8) WHAT IS INTERESTING ABOUT THE REGION OF SMALL MOMENTUM TRANSFERS AT HIGH ENERGIES? Azimov, Ya. I.; Levin, E. M.; Ryskin, M. G.; Khoze, V. A. 1974. Translation of Russian Report. (CONF-740246-1). 198p.

From 9th winter school on nuclear elementary particle physics; Leningrad, Akademiya Nauk, USSR (15 Feb 1974).

An attempt is made to give a complete review of those experiments at small momentum transfers and high energies (E_{lab} = 50 to 1000 GeV), the setting up of which would enable answers to be given to the most interesting questions posed by the modern theory of hadron scattering at high energies. The basis of these is as follows: it is not possible at the achievable energies to determine the characteristic consequences for the hadron scattering processes resulting from the hypothesis of constant cross sections at asymptotic energy? Specifically, this means the disappearance of quasi-elastic processes at zero momentum transfers, the vanishing of all vertices of vacuum Reggeon emission and of particle emission from a vacuum Reggeon, if crossed by a zero momentum. The behavior of the cross sections of the various reactions to which the above-mentioned features of asymptotic scattering lead, at real energies, is examined precisely. In spite of the fact that such examinations are of a particularly estimatory nature, the authors consider that, as a result of difficult, but in principle feasible experiments at small t and in a wide energy range, the asymptotic theory may be verified. Furthermore, the papers examine in detail questions of a more specific interest, such as the behavior of ρ = ReA/ImA for high energies, the kink in the slope of the diffraction cone at $t \approx -0.1$ $(GeV/c)^2$, hadron scattering on a deuteron target, are examined in detail. The first part may be considered as an attempt to enumerate the fundamental qualitative results of the theory of complex angular momenta. (74 figures, 3 tables) (auth)

20954 (COO-3075-70) COLOR QUARKS AND OCTONIONS. Guersey, F. (Yale Univ., New Haven, Conn. (USA). Dept. of Physics). 1974. Contract AT(11-1)-3075. 29p. (CONF-740135-2). Dep. NTIS $4.50.

From Johns Hopkins workship on current problems in high energy particle theory; Baltimore, Maryland, USA (18 Jan 1974).

A mathematical framework based on octonions is developed for the description of the color quark scheme in which quarks are unobservable, the color SU(3) is exact, and only color singlets correspond to observable hadrons. The fictitious Hilbert space in which quarks operate is taken to be a space of vectors with octonion components. This space admits as a gauge group an exact SU(3) identified with the color SU/sub C/(3). Because of the nonassociativity of the underlying algebra, nonsinglet representations of SU/sub C/(3) are unobservable, while the subspace of color singlets satisfies associativity along with conditions for observability. Octonion quark fields satisfy the commutation relations of parafermions of order 3, leading to the correct SU(6) multiplets for hadrons. (auth)

20955 (COO-3533-54) STRINGS, MONOPOLES, AND MESON STATES. Balachandran, A. P.; Ramachandran, R.; Schechter, J.; Wali, K. C.; Rupertsberger, H. (Syracuse Univ., N. Y. (USA). Dept. of Physics; Vienna Univ. (Austria). Inst. fuer Theoretische Physik). Apr 1975. 24p. (SU-4206-54). Dep. NTIS $4.25.

Dirac's formulation of the monopole theory modified by an additional mass term for the gauge field has been considered as a possible simplified model for quark binding. Methods are discussed for the consistent regularization of the infinities present in the resulting action and equations of motion. This leads to an action which is the same as that suggested by previous authors. It is shown that the expression for the energy of the modified action still has infinities unless the mass of the gauge field is infinite. Thus the regularization procedure is incomplete when the gauge field has finite mass. Applications of the regularized model to charmonium and other meson states are discussed. (auth)

20956 (DESY-L-Ueb-199) NEW e^+e^--RESONANCES AND THE HADRON CLASSIFICATION ACCORDING TO COLOR. Anselm, A. A.; Dyakonov, D. I. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). 1975. 6p. (In German). INIS.

1 tab.; 3 refs. Translated from PISMA Zh. Ehksp. Teor. Fiz., (1975) v. 21(4) p. 239-243. Available from ZAED.

The discovery of new narrow resonances in the e^+e^- system immediately gave rise to the question of their nature. In our article, we want to investigate one of the variants of the identification of these resonances with "colored" resonances. (GE)

20957 (HU-TFT-75-2) RADIAL EXPANSION IN THE HYDRODYNAMIC MODEL FOR PARTICLE PRODUCTION IN 1, 2, AND 3 DIMENSIONS. Sohlo, S.; Wilk, G. (Helsinki Univ. (Finland). Research Inst. for Theoretical Physics). Jan 1975. 12p. Dep. NTIS (US Sales Only) $4.00.

The radial expansion in the hydrodynamic model for particle production is discussed in 1, 2, and 3 dimensions. The two-dimensional expansion is used in describing hadronic reactions

in which particles with large transverse momenta are produced. The same value of the speed of sound as in the statistical bootstrap model of hadrons is found to describe the transverse hydrodynamic motion in pp-collisions and the spherical hydrodynamic motion in e^+e^--annihilation to hadrons. (auth)

20958 (JINR-P2-8878) PARTIALLY COHERENT HADRON PRODUCTION. Mal'tsev, V. M.; Sinegovskii, S. I. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 15p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

On the basis of S-matrix approach there were obtained the integral characteristics of the multiple hadron generation. The interaction modes, leading to the correlations of the short-range and long-range order, were considered. (auth)

20959 (JINR-P2-8897) MODEL FOR HIGH ENERGY HADRON SCATTERING. Mavrodiev, S. Sheh. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 23p. Dep. NTIS (US Sales Only) $4.25.

The Born amplitude of elastic scattering is obtained on the basis of the correspondence principle, relativistic Fourier analysis and the phenomenologically chosen quasipotential, having simple pole structure in relativistic relative coordinate space. The agreement of the amplitude with the proton-proton elastic scattering picture including geometrical scaling (E_L = 75 GeV/c) is tested by means of the numerical analysis. (auth)

20960 SEARCH FOR ULTRA-RELATIVISTIC QUARKS IN COSMIC RAYS. Krisor, K. (Technische Hochschule, Aachen). Nuovo Cim.; 27A: No. 2, 132-140(21 May 1975).

A proportional-counter hodoscope was used to search for ultra-relativistic fractionally charged particles. The entire charge spectrum of cosmic rays from $\frac{1}{3}$e to 1e was examined. $4.2 \cdot 10^8$ particles were analyzed in 3224 hours of running time. No event was found, and the following upper limits were derived for the quark flux with 90% confidence: $< 7 \cdot 10^{-11}$ cm^{-2} sr^{-1} s^{-1} for relativistic ($\gamma \approx 10$) quarks of charge $\frac{1}{3}$e, $< 5 \cdot 10^{-11}$ cm^{-2} sr^{-1} s^{-1} for relativistic quarks of charge $\frac{2}{3}$e and $< 1.5 \cdot 10^{-10}$ cm^2 sr^{-1} s^{-1} for ultra-relativistic ($\gamma > 1000$) quarks of charge $\frac{2}{3}$e. (auth)

20961 TOTAL CROSS SECTIONS OF HADRON COLLISIONS AND LIGHT-CONE ALGEBRA. Kakuto, A. (Nagoya Univ. (Japan). Dept. of Physics). Progr. Theor. Phys. (Kyoto); 52: No. 1, 240-248(Jul 1974).

The high energy behavior for photon (meson)-nucleon total cross sections is studied from a combined viewpoint of the light-cone dominance and eN-data. It is shown that the high energy behavior is described by the contribution from the leading light-cone singularities, if suitable scale-breaking masses are introduced. The scale-breaking masses are regarded as the effective quark masses characteristic of the kind of interacting fields. The effective quark mass for electromagnetic interaction is found to be the same as M/μ_p where M and μ_p are the mass and magnetic moment of a proton. (auth)

20962 TWO-PARTICLE RAPIDITY CORRELATIONS AND THE FLUID ANALOGY. Bose, S. K. (Southern Illinois Univ., Carbondale (USA)). Progr. Theor. Phys. (Kyoto); 52: No. 3, 1028-1030(Sep 1974).

The inclusive two-particle rapidity correlation function is assumed to obey an integral equation which occurs in the theory of classical fluids. By making certain assumptions about the exclusive correlation function, the inclusive correlation function for large rapidity separation is studied. (auth)

20963 BREAKING OF LINE REVERSE RELATION AND EXOTICS. Imachi, M.; Otsuki, S. (Kyushu Univ., Fukuoka (Japan). Dept. of Physics). Progr. Theor. Phys. (Kyoto); 52: No. 3, 971-985(Sep 1974).

Under a hypothesis that the meson-baryon reaction amplitude corresponds to the urbaryon rearrangement diagram (URD), the X type (t-u dual) URD is related to the H type (s-t dual) one in the forward region by reversing the urbaryon line. It has been taken that the X type amplitude has the magnitude equal to the H type one and is real, and that the Z type (s-u dual) amplitude is negligible; line reverse relation (LRR). There are, however, indications that the LRR is more or less broken. Two simple models resulting in the LR breaking under the URD hypothesis are investigated. (1) Z_{II} model. One of the three Z type URD's, which is named Z_{II}, has a remarkable peculiarity that its t-channel quantum numbers are non-exotic irrespective of the exotic four-urbaryon configuration. If the Z_{II} amplitude survives up to high energies from this peculiarity, an apparent LR breaking results in anti K-N $\rightarrow \pi$ Y vs. π N $\rightarrow$ KY processes. (2) Im X model. The imaginary part of the X amplitude, which may be compatible with the possible KN s-channel exotics such as $Z_0(P_8)$ and $Z_1(P_8)$, gives rise to an intrinsic LR breaking. A comparison between the two models and their consequences are examined. LR breakings in decuplet baryon production and of baryon exchange are also discussed. (auth)

20964 DIFFERENCE EQUATION AND AN EXTENDED PARTICLE MODEL OF HADRONS. Naka, S. (Nihon Univ., Tokyo. Coll. of Science and Engineering). Progr. Theor. Phys. (Kyoto); 52: No. 3, 1051-1058(Sep 1974).

An extended particle model of hadrons obeying a difference equation as its equation of motion is studied. It is shown that the present model has three kinds of excitation; rigidbody like rotational excitation, string like vibrational excitation and U(3) excitation. In especial, the U(3) excitation is obtained from the Lagrangian itself which contains derivatives of infinite order with respect to the time ordering parameter without any approximation such as the smallness of the vibration. (auth)

Strong (Baryon No. = 0)

20965 (COO-3130TA-321) COMMENTS AND CRITIQUE OF THE OMEGA anti OMEGA MODEL FOR THE NEW RESONANCES. Tow, D. M. (Brown Univ., Providence, R. I. (USA). Dept. of Physics). 1975. Contract E(11-1)-3130. 11p. (CONF-750547-9). Dep. NTIS $4.00.

From 4th international symposium on nucleon–antinucleon; Syracuse, New York, USA (2 May 1975).

The suggestion that the psi particles are OMEGA anti OMEGA compounds is briefly reviewed. Various arguments for their small widths are discussed. Crucial tests of the model are pointed out. Also comments are made on psi'' (4.15) and other B anti B systems. (auth)

20966 (DESY-75/13) COLOR AND THE NEW PARTICLES. A Brief Review. Schildknecht, D. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). May 1975. 26p. (CONF-750309-4). Dep. NTIS (US Sales Only) $4.50.

From 10th moriond meeting; Meribel-les-Allues, France (2 Mar 1975).

The possibility of interpreting the new particles as colored ω and ϕ mesons is discussed in the light of the experimental information available on widths and decay modes. (auth)

20967 (HU-TFT-75-3) STRONG AND ELECTROMAGNETIC WIDTHS OF PSI(3105) IN A BROKEN SU(4) SCHEME. Kajantie, K.; Montonen, C.; Roos, M.; Toernqvist, N. (Helsinki Univ. (Finland). Research Inst. for Theoretical Physics). Jan 1975. 28p. Dep. NTIS (US Sales Only) $4.50.

A nonrelativistic SU(4) quark model is used to estimate the decay widths for $\psi(3105) \rightarrow O^-\gamma$, $\psi \rightarrow K\bar{K}$ and $\psi \rightarrow 3\pi$. A mixing analysis of the 1^- and O^+ 16-plets is performed using as input the ψ mass and estimates of the D mass based on the relative widths of $\psi(3695)$ and $\psi(4300)$. The mass of the missing O^- state η_c is predicted and is found to be different for mixing analyses using linear and quadratic masses. The large charmed quark mass, Zweig's rule, and almost ideal mixing in the 1^- 16-plet suppress the decay widths to lie within the observed values. A possible breaking of Zweig's rule in connection with the $\phi \rightarrow 3\pi$ and $\psi \rightarrow 3\pi$ decays is discussed. (auth)

20968 (IC-74-100) POLARIZABILITY OF THE PROTON. Baiqui, A. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1974. 7p. INIS.

The wave functions of the proton obtained from the O(4,2) infinite multiplet model, which were previously used to calculate mass spectra, form factors and electromagnetic structure functions, are applied to calculate Rayleigh scattering. The polarizabilities of the proton are then extracted, and their energy dependence is explicitly demonstrated. (INIS)

20969 (INIS-mf-1728) TWO FIELD-THEORETIC MODELS WITH LOWEST ORDER RESONANCE BORN TERM. Lukierski, J. (Pontificia Universidade Catolica do Rio de Janeiro (Brazil). Instituto de Fisica). 1972. 61-93p. INIS.

From 4th Brazilian symposium on theoretical physics; Rio de Janeiro, Brazil (4 Jan 1972).

Discussed is pi–pi scattering, with particular interest in studying the consequence of the assumption that the exchange of a resonance is the lowest-order effect, and can be described by the Born term. In such a theory a basic notion is an elementary vertex, describing "on shell" the decay of a free resonance with all the details of its mass spectrum. Different possibilities are considered for introducing a resonance as a primary object. The resonance Born term is described, and the basic vertex which couples the resonance to external stable particles is introduced. It is easy to show that such a Born term can be obtained in lowest order from nonlocal theory with real and symmetric form factor and from local theory with a new elementary field representing the resonance. These two theories are compared. Finally, different ways of describing

virtual resonances in relativistic quantum field theory are described with particular attention paid to the question of the unitary condition. The main aim is to describe the interacting resonances which lie outside of the conventional framework of local relativistic quantum field theory. (INIS)

20970 (JINR-E2-8708) SOME REMARKS ON PSI PARTICLES. Bilen'kii, S. M.; Pontekorvo, B. M. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 11p. Dep. NTIS (US Sales Only) $4.00.

A possible connection of the ψ-particles with the weak interaction is discussed. An experiment is proposed which could answer the questions as to whether the decay $\psi(3.1) \rightarrow \nu\bar{\nu}$ takes place. (auth)

20971 (JINR-P1-8758) DETERMINATION OF THE REAL PART OF THE FORWARD PP AND ANTI PP SCATTERING AMPLITUDE AND OF THE DIFFERENTIAL CROSS SECTION SLOPE USING THE COSTHETA PLANE ANALYTICITY. Dumbrais, O.; Elatanov, Z.; Chernev, Kh. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 23p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

On the basis of the data on differential cross sections of elastic pp and $\bar{p}p$-scattering outside the interference region there were determined the absolute values for the real part of the forward scattering amplitude and for the differential cross section slope parameter. Optimal use of analyticity properties of the scattering amplitude in the $\cos\theta$-plane makes the basis of the method which leads to considerably greater absolute values of the real part and of the slope parameter as compared to those obtained according to the Bethe formula based on the data on differential cross sections, in the interference region. This disagreement is discussed. (auth)

20972 OSCILLATIONS IN BARYON–ANTIBARYON ELASTIC CROSS SECTIONS. Burt, P. B.; Sebhatu, M. (Celmson Univ., SC). Lett. Nuovo Cim.; 13: No. 3, 104-106(17 May 1975).

It is shown that model quantum field theories with persistent nonlinear self-interactions lead to damped oscillatory behavior in baryon-antibaryon elastic cross sections. This damped oscillatory behavior has characteristics similar to those expected from threshold effects but leads to sharper peaks in the cross section than might be expected from threshold effects. (JFP)

20973 CROSSING CONSTRAINTS IMPOSED ON THE MODULUS REPRESENTATION AND THE INVERSE OF THE $\pi\pi$ SCATTERING AMPLITUDES. Robertson, D.; Wit, R. (Max-Planck Inst. for Physics and Astrophysics, Munich). Lett. Nuovo Cim.; 13: No. 3, 119-122(17 May 1975).

Sum rules are given for $\pi\pi$ scattering amplitudes which are found to prefer those solutions to the Roy equations with larger S wave scattering lengths. (JFP)

20974 MASS DEPENDENCE OF THE ELASTIC BRANCHING RATIO FOR HADRON RESONANCES. Hamer, C. J. (Cambridge Univ., Eng.). Lett. Nuovo Cim.; 13: No. 3, 123-127(17 May 1975).

It is shown that the rapid decrease with mass of the elastic branching ratios for massive resonance decay can be readily understood as a result of statistical competition from the exponentially rising density of states predicted by the statistical bootstrap model. (JFP)

20975 STRONG GRAVITY AND THE NEW PARTICLE PSI. Keskinen, R. K.; Perko, T. E. (Univ. of Helsinki). Lett. Nuovo Cim.; 13: No. 2, 77-78(10 May 1975).

The pion is interpreted as a quantum of the strong gravity in the system of two nucleon black holes. Also the muon pair is considered as bound by strong gravity, and the Coulomb energy of the muon is found as $E = -3.0$ GeV. This result indicates that the recently found new particle $\psi(3105)$ may be the quantum of the strong gravity in the $\mu^+\mu^-$ system. (JFP)

20976 REMARKS ABOUT PSI' $\rightarrow$ PSI + 2π AND PSI $\rightarrow \omega + 2\pi$. Renard, F. M. (USTL, Montpellier, France). 13: No. 7, 247-250(14 Jun 1975).

An attempt is made to try to make explicitly clear the situation of the psi $V' \rightarrow V + \pi^+\pi^-$ decay either with direct couplings or with scalar (ϵ) effects. It is concluded that there is a significant difference in magnitude between couplings of Ψ's to ordinary hadrons and couplings of Ψ's to Ψ's plus ordinary hadrons. (JFP)

20977 RIGOROUS LOWER BOUNDS FOR THE $\pi\pi$ P-WAVE SCATTERING LENGTH. Lopez, C. (Laboratoire de Physique Theorique et Hautes Energies, Paris). Lett. Nuovo Cim.; 13: No. 2, 69-73(10 May 1975).

It is shown that the bound on a_1 is not useful phenomenologically since it is far away from the estimated values for a_1, but it is important from a theoretical point of view because the classical procedures of getting absolute and a_1-dependent bounds to not apply to a_1. This bound is found using the P-wave equation, deduced from the use of the Roy equations for improving the known bounds of the S-wave scattering length for $\pi\pi$ interactions. (JFP)

20978 TRANSVERSE-MOMENTUM SCALING IN $\pi^\pm$, $K^\pm$, p, ANTI p PRODUCTION IN PROTON–PROTON INCLUSIVE REACTIONS AT VERY HIGH ENERGIES. Misra, R. C. (Univ. of Nigeria, Nsukka). Lett. Nuovo Cim.; 13: No. 5, 181-184(31 May 1975).

It is shown that a generalized formalism can be set up similar to the KNO scaling for the transverse-momentum distribution of the produced particles in $p\bar{p}$ inclusive interactions at very high energies and the production process can either be exponential (as in the case of π^+, π^-, K^+, K^- production) or Gaussian (in the case of p and $\bar{p}$ production). (JFP)

20979 DESCRIPTION OF $\pi\pi$ SCATTERING AND THE PION ELECTROMAGNETIC PROPERTIES IN QUANTUM CHIRAL FIELD THEORY. Volkov, M. K.; Pervushin, V. N. (Joint Inst. for Nuclear Research, Dubna, USSR). Nuovo Cim.; 27A: No. 3, 277-293(1 Jun 1975).

A phase shift analysis of the $\pi\pi$ amplitude obtained in quantum chiral theory is made. The scattering lengths, the effective-range parameters for partial waves, the pion electromagnetic form factors, the pion mean-square radius, the pion polarizability and the $\gamma\gamma \rightarrow \pi\pi$ amplitude at energies essentially lower than 1 GeV are calculated. (auth)

20980 RHO EXCHANGE AND DENSITY MATRICES IN BARYON RESONANCE PRODUCTION. Gault, F. D. (Univ. of Durham, Eng.); Goldstein, G. R.; Jones, H. F. Nuovo Cim.; 27A: No. 2, 174-182(21 May 1975).

Two alternative schemes for the ρ Regge coupling to higher-spin baryons are explored. The first is based on the ρ-γ analogy, the second on a principle of minimal transversity flip. The schemes coincide in their predictions for the density matrices in $\pi N \rightarrow \pi\Delta$, where they correspond to the Stodolsky–Sakurai model, but in general yield significantly different predictions. These are spelled out in detail for the particular case of $N^*_{\frac{1}{2}+}(1688)$. (auth)

20981 PRODUCTION OF LARGE-TRANSVERSE-MOMENTUM MESONS AND LEPTON PAIRS IN PROTON–ANTIPROTON COLLISIONS. Jaroszkiewicz, G. (Cambridge Univ., Eng.). Nuovo Cim., 27A: No. 2, 121-131(21 May 1975).

The production of large-p_T pseudoscalar mesons and leptons in $p\bar{p}$ collisions is studied in the quark-parton model of Landshoff and Polkinghorne. Explicit model calculations of the quark fusion process show that, due to valence-quark exchange from both colliding hadrons, $p\bar{p}$ single-particle inclusive cross sections will be significantly larger than the corresponding pp cross sections. The direct quark-hadron scattering process is also discussed. (auth)

20982 A RESONANCE MODEL OF BOSONS BASED ON DUALITY AND THE QUARK MODEL. Igi, K.; Shimada, T. (Tokyo Univ. (Japan). Dept. of Physics). Progr. Theor. Phys. (Kyoto); 52: No. 6, 1855-1864(Dec 1974).

An s-channel resonance model of bosons for meson-meson scattering in the nonet scheme is proposed on the basis of the quark model and duality in the sense of finite-energy sum rules. Elastic widths of boson resonances in $\pi\pi$, Kπ and K-anti K scattering are predicted. (auth)

20983 INEQUALITY OF PSEUDOSCALAR-MESON WAVE FUNCTION RENORMALIZATION CONSTANTS AND ITS EXPERIMENTAL CONSEQUENCES. Ebrahim, A. (Middle East Technical Univ., Ankara). Lett. Nuovo Cim.; 13: No. 8, 297-301(21 Jun 1975).

The techniques of current algebra and Ward identities were previously used to deduce experimental consequences of chiral $SU(3) \times SU(3)$ symmetry breaking with the result that these two approaches do not have predictions that always coincide. A simple relation between the pseudoscalar-meson wave function renormalization constants that removes the discrepancy between the predictions of chiral $SU(3) \times SU(3)$ symmetry breaking obtained by the nonlinear Lagrangian and the current algebra methods is proposed. (JFP)

Strong (Baryon No. = 1)

Refer also to abstract 20917.

20984 (COO-3130-TB-188) RADIATIVE CORRECTIONS TO EXPT. 416. Backward pi N Charge Exchange. Internal Report No. 131. Chen, G. T. Y. (Brown Univ., Providence, R. I. (USA). Dept. of Physics). [nd]. Contract AT(11-1)-3130. 54p. Dep. NTIS $5.75.

The importance of radiative corrections in elastic hadronic reactions has been reported recently. This report describes the computational techniques and results of applying the radiative corrections to a backward charge-exchange scattering experiment. The particular reaction considered is pi⁻p yields pi⁰ + n + gamma. Evaluation of the Schwinger term, evaluation of the numerical integration term, evaluation of the region in which the photon is detected and a check of the unitarity condition are considered. Appendixes contain listings of computer codes written to calculate radiative corrections. (19 figures, 2 tables) (RWR)

20985 (JINR-E1-8794) STRANGENESS EXCHANGE IN HIGH-ENERGY INTERACTIONS. Mihul, A.; Angelescu, T. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 13p. Dep. NTIS (US Sales Only) $4.00.

The average strangeness transfer computed for the K⁺p interactions on the basis of the existing experimental data does not change appreciably in the 4 to 16 GeV/c beam momentum range, being negative for K⁺p and positive for K⁻p interactions. Comparison with the electric charge transfer is made. (2 figures) (auth)

20986 (JINR-E2-8857) ASYMPTOTIC BEHAVIOR OF FORM FACTOR AND INVARIANT DESCRIPTION OF PARTICLE SPATIAL DISTRIBUTION. Skachkov, N. B. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 28p. Dep. NTIS (US Sales Only) $4.50.

It is shown that transition from the standard parametrization of the electromagnetic current to the parametrization by the relativistic spin vector allows one to make a physical interpretation of a form factor in the rest frame of a particle (and not necessarily in the Breit frame!). A spatial distribution of particles is described in the configurational representation to which one goes over using expansions over unitary representations of the Lorentz group. For the proton form factor a formula was found which gives the correct "almost dipole" asymptotical behavior for its form factor. (auth)

20987 (JINR-P1-8719) SCALING OF TOPOLOGICAL CROSS SECTIONS RELATIVE TO THE LONGITUDINAL AND TRANSVERSE MOMENTA. Angelov, N.; Akhababyan, N. O.; Grekova, L. D.; Mel'nikova, N. N.; Penev, V. N.; Solomin, A. N.; Shklovskaya, A. I.; Shcheglova, L. M. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 19p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

One-particle spectra of longitudinal and transverse momenta of mesons were studied in the c.m.s. of π^-p interactions at 40 GeV/c. The obtained experimental data were compared with those for pp-interactions at 300 GeV/c and lower energies. It is shown that the form of distribution of longitudinal and transverse momenta reveals the scaling properties independent of multiplicity, type of particles and initial energy and can be described by universal functions. (4 tables, 3 figures) (auth)

20988 (LBL-3810) SEARCH FOR ERICSON FLUCTUATIONS IN pi⁺p SCATTERING AT 3.7 AND 7.1 GeV/c. Michael, W.; Gidal, G. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jul 1975. Contract W-7405-ENG-48. 13p. (CONF-750723-11). Dep. NTIS $4.00.

From international conference on radiation test facilities for the CTR surface and materials program; Argonne, Illinois, USA (15 Jul 1975).

Data on pi⁺p elastic scattering, obtained from two high-statistics bubble chamber exposures at 3.7 and 7.1 GeV/c beam momentum, were examined for Ericson fluctuations. No evidence for such fluctuations was found. It is shown that fixed-u features of the differential cross section will lead to nonzero values of the asymmetry parameter at fixed-t. (11 figures) (auth)

20989 (ORO-4856-8) INVARIANT POTENTIAL FOR ELASTIC PION-NUCLEUS SCATTERING. Technical Report No. 75-075. Cammarata, J. B.; Banerjee, M. K. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). Apr 1975. 51p. Dep. NTIS $5.75.

From the Wick-Dyson expansion of the exact propagator of a pion in the presence of a nucleus an invariant potential for crossing symmetric, elastic pion-nucleus scattering is obtained in terms of a series of pion-nucleon diagrams. The Chew-Low theory is used to develop a model in which the most important class of diagrams is effectively summed. Included in this model is the Exclusion Principle restriction on the pion-bound nucleon interaction, the effects of the binding of nucleons, a kinematic transformation of energy from the lab to the πN center of mass frames, and the Fermi motion and recoil of the target nucleons. From a numerical study of the effects of these processes on the π-^{12}C total cross section, the relative importance of each is determined. Other processes contributing to the elastic scattering of pions not included in the present model are also discussed. (9 figures) (auth)

20990 TEST OF UNIVERSAL BEHAVIOR OF VECTOR AND TENSOR EXCHANGES. Girardi, G.; Navelet, H. (CEN de Saclay, Gif-sur-Yvette, France). Lett. Nuovo Cim.; 13: No. 6, 213-217(7 Jun 1975).

The hypercharge-exchange reactions π N and KN with the K(892) and K(1420) contributions are considered for the study of vector and tensor amplitudes. It is found that the systematics works very well for the vector and tensor exchanges and that the amplitudes used are compatible with SU(3) symmetry. It is clear from the studied reactions that the systematics explains quite different reactions with very few hypotheses and yields in a simple way substantial information on the underlying exchanged amplitudes. Values of the different coupling factors together with corresponding SU(3) F-couplings are given. (JFP)

20991 IMAGINARY PART OF THE ANOMALOUS MAGNETIC MOMENT OF THE Δ(1236). Eeg, J. O. (Univ., Oslo). Lett. Nuovo Cim.; 13: No. 3, 89-94(17 May 1975).

Contributions to the imaginary part of the anomalous magnetic moment of the Δ (produced in πN scattering) are calculated to zeroth order in e corresponding to an amplitude of first order from unitarity integrals in the stable-particle approximation. The task is to calculate the contributions corresponding to the pion and nucleon exchange graphs. (JFP)

20992 RESONANCE PRODUCTION IN THE REACTIONS $\pi^+d \to p_s p\pi^+\pi^-$ AND $\pi^+d \to p_s p\pi^+\pi^-\pi^0$ AT 11.7 GeV/c. Kemp, A. P. (Univ. of Durham, Eng.); Lotts, A. P.; Scarrott, S. M. Nuovo Cim.; 27A: No. 2, 155-173(21 May 1975).

Results are presented for the reactions $\pi^+n \to p\pi^+\pi^-$ and $\pi^+n \to p\pi^+\pi^-\pi^0$, at an incident pion beam momentum of 11.7 GeV/c. Both reactions show considerable resonance production. Reaction (1) is dominated by ρ^0 and f^0 production and there is evidence for the variation of the ρ^0 width with momentum transfer. Decay angular distributions are presented for the dipion system observed in reaction (1). Reaction (2) shows the production of both dipion and tripion resonances and there is evidence for the associated production of N-resonances with the dipion resonances. (auth)

20993 RELATIONS BETWEEN CORRELATION FUNCTIONS OF PRODUCED PARTICLES AND THE DYNAMICS OF HIGH ENERGY MULTI-PARTICLE PRODUCTION. Fukuda, H. (Tokyo Inst. of Tech. (Japan). Dept. of Physics). Progr. Theor. Phys. (Kyoto); 52: No. 3, 1013-1027(Sep 1974).

The correlation functions and the multiplicity distribution of negatively charged particles for the reaction π^--p $\to$ nπ^- (50 GeV/c) and K$^-$-p $\to$ nπ^- (33.8 GeV/c) are analyzed from an isospin invariant interaction Hamiltonian, under the assumption of the factorizable nature of matrix elements and no exotic intermediate nucleon states phenomenologically. We have rather well reproduced the experimental data where the correlation due to isospin invariance plays the important role. The relations between the correlation functions of overall particles and that of individual groups of particles are discussed. The reaction pp $\to$ nπ^- has also been analyzed. (auth)

20994 DUALITY SOLUTION AND BACKWARD MESON-BARYON SCATTERING. Matsuoka, T. (Nagoya Univ. (Japan). Dept. of Physics). Progr. Theor. Phys. (Kyoto); 52: No. 4, 1307-1325(Oct 1974).

From the viewpoint of urbaryon rearrangement, the duality condition is expressed in terms of urbaryon rearrangement amplitude of each type. The relations between the duality condition and the level structure and f/d values of baryon resonances are made clear. An interesting solution is found, which satisfies the s-u crossing relation and is consistent with leading baryon spectra and the structure of amplitudes for M-B backward scattering. (auth)

Strong (Baryon No. ≥ 2)

Refer also to abstract 21311.

20995 (COO-2232A-23) HIGH ENERGY pd yields Xd DIFFRACTION DISSOCIATION: COMPARISON TO pp yields Xp AND ANALYSIS. Goulianos, K. (Rockefeller Univ., New York (USA)). 1975. Contract E(11-1)-2232A. 15p. (CONF-750654-2). Dep. NTIS $4.00.

From international conference on high energy physics; Palermo, Italy (Jun 1975).

Cross sections for the reaction pp yields Xp in the diffraction dissociation region extracted from the recently reported precise Fermilab data on pd yields Xd are compared with results from Fermilab and ISR. The M^2/sub X/, t, and s dependence are dis-

cussed, and the first-moment finite mass sum rule is tested. (6 figures) (auth)

20996 (JINR-E2-8896) RELATIVISTIC FOURIER ANALYSIS, QUASIPOTENTIAL APPROACH AND PROTON–PROTON ELASTIC SCATTERING. Mavrodiev, S. Sbch.; Karadzhov, R. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 20p. Dep. NTIS (US Sales Only) $4.00.

The proton-proton elastic scattering amplitude is obtained on the basis of the relativistic Fourier analysis and phenomenologically chosen in the relative coordinate space quasipotential with simple pole structure. The agreement of the amplitude with the data is tested by means of numerical analysis. (auth)

20997 (JINR-P2-8872) πd SCATTERING PROBLEM IN THE FRAMEWORK OF THREE-PARTICLE RELATIVISTIC EQUATIONS. Kopaleishvili, T. I.; Machavariani, A. I. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 23p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

Three-particle relativistic quasipotential equations are applied to the πd scattering problem. These equations are written in the total angular momentum and isospin representation taking into account the nucleon identity. In the separable model of pair interactions there were obtained one-dimensional integral equations for partial transition matrices in terms of which the cross sections of elastic scattering of π-meson on deuteron, of the scattering with the deuteron disintegration and charge exchange were expressed. (auth)

20998 (LPNHEX-T-73-01) STUDY OF DIFFRACTION PROCESSES IN π^+ INTERACTIONS WITH DEUTERIUM AT 11.7 GeV/c; PRODUCTION OF 4 CHARGED PARTICLES IN THE FINAL STATE. Barrier, M. (Paris-6 Univ., 75 (France). Lab. de Physique Theorique et Hautes Energies; Paris-6 Univ., 75 (France)). 1973. 225p. (In French). INIS.

Description, analysis and criticism of the method used in the study of π^+d interactions at 11.7 GeV/c in the 2m CERN bubble chamber filled with deuterium are presented. An original channel separation is described. Experimental data interpretation is performed, keeping in mind a dynamical analysis using the longitudinal phase space for the following reactions π^+n yields p $\pi^+\pi^-$, π^+n yields p $\pi^+\pi^-\pi^0$, π^+d yields d $\pi^+\pi^+\pi^-$. The search for different exchange contributions in the t channel, the s or t channel helicity conservation, the behavior of p/sub T/, p*/sub parallel/, sigma and correlations at 5 GeV, 9 GeV and 11.7 GeV is attempted. (FR)

20999 (LUIP-CR-74-15) NEW INTERPRETATION OF HIGH ENERGY PROTON–NUCLEUS INTERACTION. Andersson, B.; Otterlund, I. (Lund Univ. (Sweden). Fysiska Institutionen). Nov 1974. 17p. Dep. NTIS (US Sales Only) $4.00.

Except for a contribution to the mean multiplicity correlated to repeated collisions inside the nucleus, there is an excess of shower-particles compared to single pp-collisions. When this effect is taken into account the relationship between the A-parametrisation of the multiplicity and the corresponding N_h-parametrisation can be understood. (4 figures, 2 tables) (auth)

21000 DIFFRACTIVE ONE-PARTICLE INCLUSIVE DISTRIBUTION AND POMERON-PROTON TOTAL CROSS-SECTION. Buchl, R. A. (Pahlavi Univ., Shiraz, Iran); Manesis, E. K. Lett. Nuovo Cim.; 13: No. 6, 227-231(7 Jun 1975).

The generalized optical theorem relates the inclusive cross section for the reaction ab $\to$ cX to an appropriate discontinuity for the ab$\bar{c}$ $\to$ ab$\bar{c}$ forward amplitude. The cross sections for the single-particle inclusive reaction pp $\to$ pX are considered. A dynamic model is used in which heavy clusters build up the pomeron-proton total cross sections. (JFP)

21001 POMERON GEOMETRIC STRUCTURE IN PROTON-PROTON SCATTERING. Gotsman, E. (Tel Aviv Univ., Israel); Maor, U. Lett. Nuovo Cim.; 13: No. 3, 113-118(17 May 1975).

A calculation is made for the differential cross sections for elastic proton-proton scattering at high energies in order to provide a geometrical parametrization for the pomeron which is compatible with both the low and high energy data at $t \leq 2$ (GeV)^2. A Bessel-expansion model was suggested which includes three terms. In this way all of the small-angle pp scattering data were reproduced. The main advantage of such a parametrization is that it has a simple optical interpretation and thus may serve as a starting point for a dynamic investigation. (JFP)

21002 S-MATRIX AND DUALITY: AN ANALYSIS FROM THE VIEWPOINT OF THE STRUCTURE OF HADRONS. Bandyopadhyay, P. (Indian Statistical Inst., Calcutta); De, S. S. Nuovo Cim.; 27A: No. 3, 294-303(1 Jun 1975).

It is argued that the rearrangement of the constituents (partons) of hadrons in hadronic strong interactions helps to effectively avoid the difficulties encountered in Lagrangian field theory, the S-matrix approach, and conventional dual models, and as such a proper dynamics of strong interactions can be envisaged on the basis of the structure of hadrons. In this picture duality appears to take a deeper meaning inherent in the structural aspects of hadrons rather than being a mere phenomenology. (auth)

21003 PP ELASTIC SCATTERING IN NAL AND ISR ENERGY REGIONS AND MULTIPLE SCATTERING IN THE COMPOSITE MODEL. Tanimoto, M.; Wakaizumi, S. (Hiroshima Univ. (Japan). Dept. of Physics). Progr. Theor. Phys. (Kyoto); 52: No. 3, 1000-1012(Sep 1974).

The NAL and CERN-ISR data on proton-proton elastic scattering are analyzed on the assumption of the multiple scattering process with the composite model for hadrons. The observed dip at t approximately equal to -1.4 (GeV/c)^2 is interpreted as originating from the interference between single and double scattering of urbaryons. The second dip is predicted to appear at about t approximately equal to -5 (GeV/c)^2 and, moreover, the dips are predicted to be deepest at the incident proton momentum P_L approximately equal to 250 GeV/c where the real to imaginary ratio of forward elastic amplitude crosses zero. The size and distribution status of urbaryons in the hadron are discussed. Pion-proton elastic scattering is also calculated at high energy. In addition, the superperipheral component of proton-proton elastic amplitude is discussed in connection with the forward steep diffraction peak and the positive real to imaginary ratio of forward amplitude. (auth)

21004 QUARKS AS PARTON CLUSTERS AND PROTON–PROTON SCATTERING. Kuroda, M. (Tokyo Univ. (Japan). Dept. of Physics). Progr. Theor. Phys. (Kyoto); 52: No. 4, 1302-1306(Oct 1974).

The energy dependence of high energy pp scattering is investigated on the basis of the composite model of hadrons. It is proposed that a constituent quark itself is a concentrated cluster of a sufficiently large number of partons. This is essential in reproducing the experimental data on rising pp total cross sections at high energy. The pp total cross sections and the slope parameter of the diffraction peak at much higher energies are predicted on the basis of this model. (auth)

21005 VERY LOW ENERGY PROTON–PROTON SCATTERING AND SCALER MESON EXCHANGE. Imai, K.; Nisimura, K.; Sato, H.; Tamura, N. (Kyoto Univ. (Japan). Dept. of Physics). Bull. Inst. Chem. Res., Kyoto Univ.; 52: No. 1, 142-145(Jul 1974).

The P-wave phase shifts and their mean value $^3\Delta_c$ are calculated by the One Boson Exchange [OBE] model. It seems to be difficult to reproduce consistently $^3\Delta_c$ below 25 MeV and delta ($^3P_0$) below 300 MeV. It is shown that $^3\Delta_c$ is a very sensitive parameter to the "scalar meson" exchange in the OBE model. (auth)

21006 K^+-MESON–DEUTERON SCATTERING LENGTH. Zasenko, V. I.; Peresypkin, V. V.; Petrov, N. M. (Inst. of Theoretical Physics, Kiev). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 2, 276-279(Feb 1975). (In Russian).

Using the Faddeev integral equations, the problem of elastic scattering of zero-energy K^+-mesons by deuterons is considered. It is supposed that the two-body interaction takes place only in the S-state and is described by a one-term interaction potential with separable variables. The dependence of the K^+d-scattering length on the form of the two-body interaction and on the value of isosinglet K^+N-scattering length is studied. (auth)

Particle Invariance Principles and Symmetries

General

21007 (CNRS-CPT-74-P-665) SPONTANEOUSLY BROKEN GAUGE SYMMETRIES AND SUPERSELECTION RULES. Roberts, J. E. (Centre National de la Recherche Scientifique, 13- Marseille (France). Centre de Physique Theorique). Nov 1974. 15p. INIS.

Spontaneously broken gauge symmetries do not give rise to superselection rules so the superselection structure of the theory is determined by the subgroup of unbroken gauge symmetries. In the presence of broken gauge symmetries the observable algebra does not satisfy duality in the vacuum sector. (FR)

21008 (CRN/PN-74-18) POINCARE GROUP REPRESENTATIONS AND IMAGINARY MASSES. Fernandez-Garcia, B. (Centre National de la Recherche Scientifique, 67- Strasbourg (France). Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67 (France)). 1974. 69p. (In French). INIS.

An analysis of irreducible representations of the orthochronous proper Poincare group has been done by the simple method used for real mass particles. The results obtained are the same as those obtained by Bargmann. Some properties of Carroll's group, analogous of inhomogeneous Galilean group, permit one to postulate the Carrollean causality. The reinterpretation principle is contained in it. A pragmatic and simple principle that permits identification of a spinless tachyon Lagrangian with the Goldstone boson used in the unified gauge field theory is postulated. (FR)

21009 TWO APPLICATIONS OF THE RACAH COEFFICIENTS OF THE POINCARE GROUP. Klink, W. H. (Univ. of Iowa, Iowa City). J. Math. Phys. (N.Y.); 16: No. 6, 1247-1252(Jun 1975).

Racah coefficients of the Poincare group are defined and compared with the rotation group. It is then shown how they arise in a natural manner in the inelastic unitarity equations and in crossing multiparticle amplitudes. (auth)

21010 ABSORPTION IN MULTIPARTICLE PRODUCTION AND THE INCLUSIVE TRANSVERSE-MOMENTUM DISTRIBUTION BASED ON THE ABSORBED INDEPENDENT-EMISSION MODEL. Chiu, C. B.; Wang, K. H. (Univ. of Texas, Austin). Nuovo Cim.; 27A: No. 2, 213-228(21 May 1975).

Absorption is investigated in multiparticle production, and explicit expressions are derived for absorbed inclusive momentum distributions. It is demonstrated that the parameter-free predictions of the inclusive transverse-momentum distribution based on earlier solution to the pp elastic scattering reproduce the gross feature of the data. (auth)

21011 GAUGE FREEDOM IN DUAL FEYNMAN-LIKE RULES AND ITS RELATION TO THE MASSLESS YANG-MILLS FIELD THEORY. Yoneya, T. (Hokkaido Univ., Sapporo (Japan). Dept. of Physics). Progr. Theor. Phys. (Kyoto); 52: No. 4, 1355-1368 (Oct 1974).

The relation between the factorization schemes in previously proposed Feynman-like rules for the Veneziano model and the gauge freedom in the massless Yang-Mills field is investigated. We consider the case of the unit intercept and introduce to our rules the Chan-Paton U(2) factors. By taking a zero-slope limit of the Feynman-like rules in two different factorization schemes, two forms of the Feynman rules for the massless Yang-Mills field are derived. One of them is in the usual Feynman gauge and the other is in a special non-hermitian gauge which has been proposed by Gervais and Neveu. The zero-slope limit of the usual off-mass-shell n-Reggeon vertex has a peculiar feature which cannot be described by Lagrangians. Nevertheless, it is shown that the on-mass-shell physical amplitudes can be described by Lagrangians. The investigations are confined in the tree approximation. (auth)

21012 SPONTANEOUS BREAKING OF SYMMETRY IN A VECTOR-GLUON MODEL. Maskawa, T.; Nakajima, H. (Kyoto Univ. (Japan). Dept. of Physics). Progr. Theor. Phys. (Kyoto); 52: No. 4, 1326-1354(Oct 1974).

Solutions of the self-consistent equation for fermion propagator in a vector-gluon model are fully examined. The equation is characterized by a set of parameters, i.e., the coupling constant g, the bare mass of the fermion m_0 and the cutoff Λ. It is proved that with a suitable gauge chosen, the equation without cutoff has solutions only in the case $m_0 = 0$. It is then shown that, if $g^2/4\pi < (16/33)^2\pi$, the number of the solution is infinity of continuum. This situation does not come from the freedom of fixing the mass scale since the gluon mass is chosen to be non-vanishing. When the cutoff is introduced, the equation has a unique solution for $g^2/4\pi < \pi/4$. In this case, however, β turns out to be identically zero if we put $m_0 = 0$, which means that any "superconducting" solutions do not exist for such a value of g irrespective of cutoff momentum; that is, there are no Nambu-Goldstone bosons. When g^2 is large enough, such a "superconducting" solution does exist in the model in which the vector part of the inverse fermion propagator is identically set equal to unity. Furthermore, the existence of many "superconducting" solutions is inferred in this model. It is also found that in the region $g^2/4\pi > 8\pi$, the "normal-state" solution for the equation without cutoff, even if it existed, should necessarily have an unphysical singularity. This fact implies that the "normal-state" solution becomes unstable for a sufficiently large value of g^2. (auth)

21013 SU(3) MASS FORMULAE. Tybor, W. (Univ., Lodz, Poland). Ann. Phys. (Leipzig); 31: No. 2, 137-142(Jun 1974).

It is found that in the SU(3) broken quark model the SU(3) generators and their time derivatives belong to the SU(3) × SU(3) algebra. Using this algebra and the infinite momentum method the SU(3) mass sum rules are obtained. The possibility is discussed that normal spin-parity nonets and anomalous ones differ in the structure of the mass spectrum. (1 table) (auth)

Applications (Electromagnetic and Weak)

Refer also to abstracts 19339, 20946, and 21157.

21014 (ORO-3992-183) POINCARE GROUP, SU(3) AND V-A IN LEPTONIC DECAY. Boehm, A. (Texas Univ., Austin (USA). Center for Particle Theory). Jul 1975. Contract AT(40-1)-3992. 56p. Dep. NTIS $6.00.

From as few assumptions as possible about the relations between the Poincare group, the particle classifying SU(3) and V-A we derive properties of the K/sub l_3/ and K/sub L_2/ decays. From the assumed relation between SU(3) and the Poincare group and the first class condition it follows that the formfactor ratio Xi of K/sub l_3/ decay is Xi equals −0.57, and that a value of Xi equals 0 is in disagreement with very general and well accepted theoretical assumptions. Assuming universality of V-A, the Cabibbo suppression is derived from the relations between SU(3) and V-A as a consequence of the brokenness of SU(3). (auth)

21015 POSSIBLE VIOLATION OF CP-INVARIANCE IN THE DECAYS OF CHARMED PARTICLES. Okun, L. B. (Joint Inst. for Nuclear Research, Dubna, USSR); Zakharov, V. I.; Pontecorvo, B. M. Lett. Nuovo Cim.; 13: No. 6, 218-220(7 Jun 1975).

It is discussed how possible CP-invariance effects in the decays of D^0 mesons could be searched for experimentally. It is found that the charge asymmetry could be looked for in the K μ_{μ} modes and also in other decay channels. It is noted that an intermediate resonance is not necessary for observing CP violation. The superweak model of CP violation is discussed. It is mentioned that the observation of these effects could give a clue to the understanding of the whole problem of CP violation. (JFP)

21016 EIGENVALUES OF THE INVARIANT OPERATORS OF THE ORTHOGONAL AND SYMPLECTIC GROUPS. Wong, M. K. F. (Fairfield Univ., CT); Yeh, H. Y. (Fairfield Univ., CT). J. Math. Phys. (N.Y.); 16: No. 6, 1239-1243(Jun 1975).

Eigenvalues of the invariant operators of the orthogonal and symplectic groups have been obtained in closed form. All semi-simple Lie groups, the unitary, orthogonal, and symplectic groups, are treated in a systematic way by modifying Perelomov and Popov's method. The eigenvalues of the invariant operators for the orthogonal and symplectic groups are then calculated with reference to the unitary group. (auth)

21017 GAUGE INVARIANT PION REGGE POLE. Takahashi, K. (Tohoku Univ., Sendai (Japan). Dept. of Physics); Ebata, T. Progr. Theor. Phys. (Kyoto); 52: No. 4, 1288-1301(Oct 1974).

Reggeization of the pion exchange amplitude in virtual photon-pion production is discussed. It is shown that the formulation is consistent with the electric Born term and that the electric Born dominance at small absolute t is a natural consequence of the Reggeization of pions. FESR and the Reggeized pion suggest the electric Born dominance also for the natural parity exchange part. The application of the formulation to the process $ep \rightarrow e\pi^+X$ is also discussed. (auth)

Applications (Strong)

Refer also to abstracts 20927, 20954, and 21079.

21018 (LA-UR-75-1281) IMPLICATIONS OF PARITY VIOLATING EFFECTS IN STRANGENESS CONSERVING NON-LEPTONIC PROCESSES. Herczeg, P. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-eng-36. (CONF-750631-8). Dep. NTIS $4.00.

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975).

Evidence for parity violation in nonleptonic nuclear processes began to accumulate about a decade ago. This paper discusses the information obtainable from the various experimental results regarding the question of the origin of these effects, and reviews some theoretical ideas which have recently been discussed in this connection. Reference is made to the alpha decay of the 8.88-MeV level of ^{16}O, the circular polarization in the capture of unpolarized thermal neutrons by protons, and the asymmetry in ^{19}F gamma decay. Exchange-current contributions, parity violation in the electromagnetic interactions, large isotensor parity-violating forces, and isotensor axial vector electromagnetic currents are considered. (RWR)

21019 GENERAL CHIRAL $SU_2 \times SU_2$ PION LAGRANGIAN AND THE GENERATORS OF O (4,1) GROUP. Ebrahim, A. (Middle East Tech. Univ., Ankara). J. Math. Phys. (N.Y.); 16: No. 6, 1253-1255(Jun 1975).

It is shown that the general chiral $SU_2 \times SU_2$ invariant pion Lagrangian in the form given by Gursey can be used to obtain a

general and convenient parametrization of an infinite set of generators of the noncompact O(4,1) group. Various special cases of the general form of the generators are given, and one particular form is shown to coincide with the generators of the O(4,1) group used in the literature. (auth)

21020 COMPOSITE MODEL AND HIGH-ENERGY BEHAVIOR OF THE HADRONIC PROCESS. Koike, K. (Kyoto Univ. (Japan). Dept. of Physics). Progr. Theor. Phys. (Kyoto); 52: No. 1, 249-258(Jul 1974).

Under an assumption that the scattering amplitudes of quarks are chiral SU(3) × SU(3) symmetric it is shown that s-channel helicity is conserved for the elastic process of hadrons in the asymptotic region. Further a conjecture that the scattering amplitudes of quarks are proportional to the inverse of effective quark mass is proposed. This conjecture gives a possible explanation of the ratios of the total cross sections $\sigma_{\bar{A}N}\sigma_{NN}$, etc. (auth)

21021 DUALITY CONSTRAINTS AND REPRESENTATION MIXINGS IN LIGHT-LIKE ALGEBRA. Kuroiwa, T. (Kyushu Univ., Fukuoka (Japan). Dept of Physics); Yamawaki, K.; Kugo, T. Progr. Theor. Phys. (Kyoto); 52: No. 4, 1274-1287(Oct 1974).

Within the framework of light-like chiral algebra $SU(3)_l \times SU(3)_l$ the mixing scheme for meson resonances is investigated. The mixing angles of representations are determined from duality constraints with an assumption about the variation of Regge residues. In particular, equal-weight mixing between the pseudoscalar and axial vector mesons is obtained. All the observed pionic couplings are fitted well with one parameter for each helicity. Consistency of our results with mass relations of Weinberg's and others is also studied. (auth)

Scattering Theory

Refer also to abstract 21020.

21022 (CNRS-CPT-74-P-635) TIME DEPENDENT SCATTERING THEORY. Robinson, D. W. (Centre National de la Recherche Scientifique, 13- Marseille (France). Centre de Physique Theorique). Jul 1974. 23p. INIS.

The general formalism of time-dependent quantum mechanical scattering theory is reviewed and a large number of relatively recent results is given. (FR)

21023 EIKONAL PROBLEM AND THE ASYMPTOTIC QUASIPOTENTIAL. Kuleshov, S. P.; Matveev, V. A.; Sissakian, A. N.; Smondyrev, M. A.; Tavkhelidze, A. N. (Joint Inst. for Nuclear Research, Dubna, USSR). Phys. Fenn.; 9: No. 3, 151-165(Oct 1974).

The structure of "noneikonal" contributions to the scattering amplitude and its connection with the asymptotic quasipotential is studied. (auth)

21024 CROSS SECTIONS IN QUANTUM MECHANICS. Campesino-Romeo, E.; Taylor, J. R. (Univ. of Colorado, Boulder). J. Math. Phys. (N.Y.); 16: No. 6, 1227-1230(Jun 1975).

The definition of scattering cross sections requires an averaging over wavepackets with random impact parameters rho; this leads to an integral of the scattering probability over all rho in a plane perpendicular to the incident beam. It is shown that, for scattering off a potential which is O(1/r/sup beta/) as r yields infinity, the scattering probability is O(1/rho/sup 2 beta-4/) as rho yields infinity. Thus for any beta greater than 3, the integral over impact parameters is well-defined and convergent. (auth)

21025 UNITARITY OF S-MATRIX IN GRAVIDYNAMICS AND GENERAL COVARIANCE IN QUANTUM DOMAIN. Fradkin, E. S. (Lebedev Inst. of Physics, Moscow); Vilkoviskii, G. A. (Lebedev Inst. of Physics, Moscow). Lett. Nuovo Cim.; 13: No. 5, 187-192(31 May 1975).

The first correct proof of the unitarity and gauge independence of the S matrix for the case of gravidynamics is given. (JFP)

21026 KINEMATICAL REGULARIZATION AND KINEMATICAL CONSTRAINTS OF N-PARTICLE HELICITY AMPLITUDES. Dumitru, D. R. (Scuola Normale Superiore, Pisa, Italy). Nuovo Cim.; 27A: No. 2, 229-248(21 May 1975).

Kinematical analyticity properties of n-particle center-of-mass helicity amplitudes ($n \geq 5$, massive particles) are studied. A covariant procedure based on the assumed holomorphy of spinor amplitudes and on the properties of certain sets of covariant polynomials of the four-momenta that emerge in a suitable decomposition of direct products of helicity spinors is used. The singularities due to the nonzero spins are removed, and one derives kinematically regularized helicity amplitudes and a complete set of kinematical constraints between them. (auth)

21027 FADDEEV'S EQUATIONS FOR THREE PARTICLES WITH SPIN. Zanon, D. (Univ., Milan). Nuovo Cim.; 27A: No. 2, 203-212(21 May 1975).

An approach to the angular-momentum reduction of Faddeev's equations for three identical particles with spin is given. It is shown that introducing an appropriate basis of functions one obtains a set of coupled integral equations in two variables. Hopefully these resulting integral equations will be useful in numerical calculations assuming realistic two-body potentials with tensor forces and soft cores. (auth)

21028 THEORY OF SCATTERING IN THREE-PARTICLE SYSTEM. Hirooka, M.; Sunakawa, S. (Osaka Univ., Toyonaka (Japan). Coll. of General Education). Progr. Theor. Phys. (Kyoto); 52: No. 1, 131-146(Jul 1974).

A theory of scattering in three-particle systems is proposed. The Hamiltonian of the system is described in a coordinate system which is appropriate for representing the three-particle system. After a unitary transformation, the basic Hamiltonian satisfying the asymptotic condition is obtained. On the basis of this Hamiltonian, the orthogonality of the scattering states for different channels is exhibited in an exact way. The S-matrix involves explicitly the contribution from the indirect interactions between two particles through the motion of the third particle. With the aid of the orthogonal character of the scattering states, a generalized optical theorem in three-particle system is derived. The integral equation for the scattering amplitude is transformed so as to be able to have a convergent series which does not involve any disconnected diagram. (auth)

21029 UNIQUENESS IN THE RECONSTRUCTION OF PURELY ELASTIC AND SPINLESS SCATTERING AMPLITUDES FROM DIFFERENTIAL CROSS SECTIONS. Cornille, H. (Inst. de Physique Nucleaire, Orsay, France). Lett. Nuovo Cim.; 13: No. 8, 273-278(21 Jun 1975).

Previously work was done on the determination of a sufficient condition such that the nonlinear elastic and spinless unitarity equation for the phase of the amplitude admits a unique solution. It is deduced that by a change in the parameters one could obtain the uniqueness property of the solution in some cases where the old parameters cannot. It is shown that by taking into account some supplementary information one can improve these previous results. It is found that depending on whether one considers as given quantities sin μ or (sin ν, sin μ, y) or (m, M) or (m, M, y) one can obtain different uniqueness domains in the corresponding parameter space. (JFP)

21030 SCATTERING THEORY FOR DISSIPATIVE HYPERBOLIC SYSTEMS. Lax, P. D. (New York Univ., NY); Phillips, R. S. J. Funct. Anal.; 14: No. 2, 172-235(Oct 1973).

An abstract theory of scattering is developed for dissipative hyperbolic systems, a typical example is the wave equation: u/sub tt/ equals DELTAu in an exterior domain with lossy boundary conditions: u/sub n/ + alphau/sub t/ equals 0, alpha greater than or equal to 0. In this theory, a central role is played by two distinguished subspaces of data common to both the perturbed and unperturbed problems. Associated with each subspace is a translation representation of the unperturbed system. When these representations coincide they provide a convenient tool for extending the data so as to include a large class of generalized eigenfunctions for both the perturbed and unperturbed generators. The scattering matrix is characterized in terms of these generalized eigenfunctions; it is shown to be meromorphic in the whole complex plane and holomorphic in the lower half plane. The zeroes and poles of the scattering matrix correspond, respectively, to incoming and outgoing generalized eigenfunctions of the perturbed generator. The assumptions introduced in the abstract theory are verified for the wave equation problem cited above. (auth)

PHYSICS (LOW-TEMPERATURE)

21031 (BNL-20155) RECENT EXPERIMENTS ON THE SURFACE OF LIQUID ^{4}He: ELASTIC SCATTERING OF ^{4}He ATOMS. Edwards, D. O.; Fatouros, P. P.; Ihas, G. G.; Mrozinski, P.; Shen, S. Y.; Tam, C. P. (Brookhaven National Lab., Upton, N. Y. (USA)). 1975. 19p. (CONF-750130-1). Dep. NTIS $4.00.

From international research workshop, and international symposium on quantum fluids; Sanibel, Florida, USA (26 Jan 1975).

The first part of the paper concerns the experimental determination of the two-dimensional effective interaction potential between ^{3}He atoms adsorbed on the surface of liquid ^{4}He. Measurements of the velocity of surface sound and of the surface tension indicate that, for concentrations of ^{3}He corresponding to a small fraction of a monolayer, the interaction is very weak and predominantly repulsive. This is unfavorable for a low-temperature superfluid condensation. The bulk of the paper discusses the implications of a recent experiment on the elastic scattering of free ^{4}He atoms at the surface of pure liquid ^{4}He. The elastic scattering probability R(k, theta) has been measured as a function of the momentum of the atom hk/2 pi and of the angle of incidence theta. In addition the probability of inelastic scattering was found to be very small (less than 2×10^{-3}). With the simplifying assumption that the scattered atoms can be treated as distinguishable from those in the liquid it is found that R(k, theta) can be calculated from the density profile rho (z) at the surface of the liquid. The relation between the scattering data and the spectrum of atoms evaporated from the liquid at finite temperature is also discussed. (4 figures) (auth)

Superfluidity

Refer also to abstracts 19615, 21042, and 21047.

21032 (ANL-8153, pp 123-126) FUNDAMENTAL STUDIES ON IMPORTANT LIQUIDS. Jan 1975.

In Chemistry Division annual report, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

Phonon attenuation and velocity measurements in the range W tau greater than KT have been undertaken for ^{3}He, ^{4}He, and solutions. Specifically, anisotropic source propagation in superfluid ^{3}He and ultrasonic attenuation in liquid ^{3}He as a function of pressure from 35 to 500 MK are reported. (SDF)

21033 (NRC/CNR-TT-1797) SIZE EFFECTS IN SUPERFLUID HELIUM. II. Investigation by a Functional Method. Maki, K.; Guyon, E. Translated by D. A. Sinclair from J. Phys. (Paris); 30: No. 1, 63-70(1969). 15p. Dep. NTIS (US Sales Only) $4.00.

A model of the critical behavior of the superfluid phase of helium consistent with the general idea of the phase transition of Landau is presented. The model explains the logarithmic singularity of the bulk helium at the lambda point which is not obtained in the original theory of Ginzburg and Pitaevskii. Here the fluctuations of the order parameter play a dominant role in the properties of the system. In the framework of this model we can calculate the superfluid density in good agreement with recent experimental results. Making a simple assumption on the geometrical configuration we discuss the critical properties of helium due to size effects: shift in the transition temperature T_θ and specific heat and superfluid density near T_θ. (auth)

21034 NMR PROPERTIES OF THE A PHASE OF LIQUID ^{3}He. Takagi, S. (Univ. of Sussex, Eng.). J. Phys., C (London); 8: No. 10, 1507-1515(21 May 1975).

Some of the remarkable NMR properties of superfluid ^{3}He-A contained in a slab thinner than a certain characteristic thickness ($\sim 10^{-3}$ cm) with a static magnetic field applied perpendicular to the slab are discussed. Below a characteristic field ($\sim$ 20 G) there appear two transverse resonance lines. Above it there is one line with a negative shift. The integrated absorption (Kramers-Kronig sum rule) is larger than that in the bulk. These effects provide a useful means to measure the susceptibility anisotropy. Similar phenomena occur in the bulk when there is a superflow. The resonance frequencies are obtained as functions of the flow velocity. (auth)

21035 EXCITATIONS IN LIQUID AND SOLID HELIUM FOUR. Reatto, L. (Univ., Milan). Riv. Nuovo Cim.; 5: No. 1, 108-134 (1975).

In recent years several new aspects of the microscopic dynamics of He II have been unraveled, as manifested by its excitations. Recent experiments in solid He have shown that this phase also has a more complicated behavior than was suspected, and striking similarities have been found in the microscopic dynamics of the liquid and of the solid phase. After an introductory section, recent data are discussed with the relevant theoretical advances; excitations in the liquid are treated before the dynamics of quantum solids. Finally, the possibility of Bose–Einstein condensation in quantum solids is discussed. (7 figures) (RWR)

21036 ROTON SPECTRUM IN SUPERFLUID MIXTURE OF He^3 AND He^4. Ohmi, T.; Kawamoto, H.; Tsuneto, T. (Kyoto Univ. (Japan). Dept. of Physics). Progr. Theor. Phys. (Kyoto); 52: No. 1, 17-41(Jul 1974).

The spectrum of rotons in superfluid solutions of He^3 and He^4 is studied theoretically in the dilute limit of He^3. Both the emission-absorption type and the scattering type interaction between rotons and He^3 quasi-particles are assumed, and the shift and the width of the roton energy at its minimum as well as the diffusion constant of He^3 are calculated. The Raman scattering and the normal fluid density in the solutions are also studied. The results of the measurements of the normal fluid density and of the Raman and the neutron scattering experiments are discussed on the basis of the analysis. (auth)

21037 ON AXIALLY- AND SPHERICALLY-SYMMETRIC SUPERFLUIDITY IN COUPLED FERMION SYSTEM. Kawamura, K. (Hiroshima Univ. (Japan). Faculty of Engineering). Progr. Theor. Phys. (Kyoto); 52: No. 3, 786-792(Sep 1974).

The gap parameter in the axially symmetric superfluid is written in terms of spherical harmonics. In particular, an isotropic superfluid does not exist except $l = 0$ and 1. Assumptions used are (i) a state with a single-valued l is realized, and (ii) for l is odd our system has the mirror-image-symmetry. (auth)

21038 EXCITATION ENERGY OF LIQUID HELIUM II. Grest, G. S.; Rajagopal, A. K. (Louisiana State Univ., Baton Rouge (USA). Dept. of Physics and Astronomy). Progr. Theor. Phys. (Kyoto); 52: No. 3, 811-821(Sep 1974).

The excitation spectrum of liquid Helium II is re-examined using the formalism developed by Sunakawa et al. In this formalism, certain divergent terms appear - a constant term and the terms involving products of two field operators. It is necessary to retain them in order to obtain convergent results in perturbation calculations. Results for the energy spectrum and structure factor are derived in perturbation theory and are thus shown to be convergent in contrast to the earlier observations by Sunakawa et al. to the contrary. Similar corrections are also derived for the temperature dependent formalism developed recently by Kebukawa. The new expression for the excitation energy is numerically evaluated in such a way as not to depend on model interatomic potentials and is found only to be in fair agreement with experimental results. (auth)

21039 MAGNETIZATION OSCILLATION IN THE B PHASE OF SUPERFLUID ^{3}He. Maki, K.; Hu, C. R. (Univ. of Southern California, Los Angeles). J. Low Temp. Phys.; 19: No. 3-4, 259-268(May 1974).

The ringing phenomena in magnetization in the B phase (assumed to be the Balian–Werthamer state) after a sudden application of magnetic fields are analyzed theoretically. Particular attention is paid to the wall-fixed geometry, where the oscillation is intrinsically nonlinear. The ringing frequency is determined as a function of both the external field and the change in the magnetic field. (auth)

Superconductivity

Refer also to abstracts 20230, 20254, 20326, 20344, 20352–20354, 20359, 20362, 20378, and 20402.

21040 (CALT-822-74) ON THE CRITICAL TEMPERATURE OF SUPERCONDUCTORS. Poon, S. J. (California Inst. of Tech., Pasadena (USA)). Jun 1975. Contract AT(04-3)-822. 33p. Dep. NTIS $4.75.

An exact expression for the superconducting transition temperature is derived from the Eliashberg equation at T equals T/sub c/ taking the energy gap function in the two-square-well form. The expression is improved for self-consistency by using available tunneling data. It is found to give more restricted values of T /sub c/ than the McMillan equation. The prospects of obtaining high T/sub c/ in alloy systems are discussed within the framework of the new equation. (6 figures, 2 tables) (auth)

21041 (COO-2456-11) PHYSICAL AND NUMERICAL DISSIPATION AND DISPERSION IN VISCOUS COMPRESSIBLE FLOW COMPUTATION. Chu, C. K. (Columbia Univ., New York (USA)). 1975. Contract AT(11-1)-2456. 20p. (CONF-750352-1). Dep. NTIS $4.00.

From symposium on unsteady aerodynamics; Tucson, Arizona, USA (18 Mar 1975).

A general view is given of the roles of numerical dissipation and numerical dispersion in finite difference schemes for unsteady fluid dynamics and for unsteady magnetohydrodynamics, and of the problem of differentiating these numerical properties from the physical properties. These questions are studied by means of simple model equations, rather than in terms of the full set of Navier–Stokes or magnetohydrodynamic equations, but the ideas and results are generalizable to the full equations relatively directly. In the treatment of steady flows as long-time limits of time-dependent flows, it is found that a comparatively inaccurate time-dependent scheme may produce an accurate steady state, and vice versa. (3 figures) (RWR)

21042 (FRNC-TH-509) STUDY OF THE EFFECT OF A TRANSVERSE MAGNETIC OR ELECTRIC FIELD ON A SUPERSONIC IONIZED ARGON FLOW: CASE OF AN ELECTRIC DISCHARGE; CASE OF MHD CONVERSION. Fontaine, B. (Aix-Marseille-1 Univ., 13- Marseille (France)). 1973. vp. (In French). INIS.

The action of magnetic or electric fields on a supersonic flow of ionized gas, created by propagation of a strong shock wave in a MHD nozzle equipped with equipotential electrodes, was studied experimentally and theoretically. Two kinds of interaction were considered especially. In the first case an electric field was applied perpendicularly to the flow under conditions where the thermal energy injected by Joule effect was equivalent to the total enthalpy of the plasma (pure discharge). In the second a magnetic field, parallel to the electrodes connected to one another by a low charge resistance, was applied across the flow (MHD conversion). In both cases the work of the delaying Laplace forces set up in the flow was of the same order as the enthalpy of flow. The experimental study was carried out under argon in a shock-tube. The test conditions were 10,5 less than or equal to $M_0(C_1)$ less than or eqial to 12,5; p_1 equals 5 torr; E(A) less than or equal to 4.10^4 v.m^{-1}; B equals 1,3 or 2 Tesla. Optical diagnostic methods involving lasers were developed and used: a light source consisting of a long-pulsed ionic laser for two-wavelength interferometry and plasma strioscopy; an infrared laser interferometer to measure the local electron density. A comparison of the experimental results with existing theories showed that under the present conditions the theoretical models give a good account of the flow properties behind a strong shock wave under argon, obtained in a shock tube. A digital analysis of the interaction induced flow was undertaken using the characteristics method. The flow was considered unidimensional and nonstationary. The formation and propagation of a secondary shock wave in the flow was studied from the set of characteristics. (FR)

21043 (SFB-MHD-17) STABILIZATION OF FREE CONDUCTING LAYERS BY A TRANSVERSE MAGNETIC FIELD. Plaschko, P. (Technische Univ. Berlin (F. R. Germany). Sonderforschungsbereich Magnetohydrodynamik). Dec 1974. 43p. (In German). Dep. NTIS (US Sales Only) $5.25.

A theoretical study of the MHD stability of free conducting layers in a transverse magnetic field was performed with the aid of linearized stability theory in the limit of very small magnetic Reynolds numbers and with restriction to plane disturbances. The corresponding stability equation was set up, and from it a new type of matching condition, indicating the continuity of a pressure built up by the hydrodynamical pressure and an additional magnetic one, was derived. Furthermore, the application of arbitrary velocity profiles is restricted to the regime of very small interaction parameters. For greater values of this parameter a velocity profile, which is consistent with the nonmagnetic limit, was deduced, and the corresponding eigenvalue equation for the case of a vortex sheet between an insulator and a conducting fluid was derived. Its solutions indicate that the generator as well as the pump case are stabilized better than the idling-motion case, which corresponds to the stability behavior in a longitudinal field. (6 figures, 5 tables) (auth)

21044 ZERO SOUND IN SUPERCONDUCTORS. Pashitskii, E. A.; Shpigel, A. S. (Inst. of Physics, Kiev). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 3, 514-516(Mar 1975). (In Russian).

It was shown that the self-consistent interaction between quasiparticles in superconductors, caused by the presence of coupling potentials (order parameters), leads to the appearance of collective excitation of the acoustical branch with frequency $\omega_k = kv_F$ (where v_F is the velocity on the Fermi surface). This branch, corresponding to the anisotropic function of the distribution function of quasiparticles in superconductors, is analogous to the zero sound in normal Fermi liquids. (tr-auth)

21045 STABILITY OF THE DC JOSEPHSON CURRENT. Zilberman, L. A. (Physico-Technical Inst., Donetsk, Ukraine). Phys. Lett.; 51A: No. 2, 95-96(10 Feb 1975).

The critical value of the current I_c, which indicates the stability region in the phase plane of the system as a whole, is approximated by an analytical relation. (1 figure) (auth)

21046 COHERENCE THEORY OF THE BOSE-EINSTEIN CONDENSATION. II. Kano, Y. (Nagoya Univ. (Japan)). J. Phys. Soc. Jap.; 37: No. 2, 310-314(Aug 1974).

The properties of the coherent state appearing in the Bose-Einstein condensation of an ideal Bose gas are discussed. The thermodynamic functions in the presence of such a coherent state are obtained. The density correlation function is derived. It is shown that the density correlation function reduces to the London-Placzek formula as temperature rises above the critical temperature of the Bose-Einstein condensation. (auth)

21047 SUPERFLUIDITY OF CHARGED BOSE GAS AND BIPOLAR MECHANISM OF SUPERCONDUCTIVITY. Vinetskii, V. L.; Pashitskii, E. A. (Inst. of Physics, Kiev). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 2, 338-341(Feb 1975). (In Russian).

Bipolarons in crystals with a large degree of ionic bonds were examined as a gas of charged bosons. It was shown that in the temperature region exceeding somewhat the temperature for the Bose condensation of an ideal Bose gas, the screening radius of the Coulomb interaction approaches zero at $T = T_0$, which is caused by the accumulation of particles with zero kinetic energy. This fact guarantees almost completely the ideality of the system and leads to a spectrum of elementary excitation satisfying the criterion of Landau superfluidity. Because of the small dimensions of the bipolarons in these crystals type II superconductivity can be expected. (tr-auth)

21048 JOSEPHSON EFFECT IN SUPERCONDUCTING RING. Bloch, F. (Saha Inst. of Nuclear Physics, Calcutta). Sci. Cult. (Calcutta); 40: No. 9, 379-384(Sep 1974).

An examination of the relationship between flux quantization and the A. C. Josephson effect is presented with the intent of deriving the Josephson relation without recourse to detailed theory. It is shown with complete rigor that a dc voltage or a uniformly increasing magnetic flux in a ring produces an alternating current with a frequency spectrum containing all frequencies which are integral multiples of eV/h. Aspects of long range ordering are also reviewed. (2 figures) (SDF)

PHYSICS (NUCLEAR)

21049 (ANU-P-611) PROGRAMS FOR NUCLEAR DATA ANALYSIS. Bell, R. A. I. (Australian National Univ., Canberra. Dept. of Nuclear Physics). Jan 1975. 16p. Dep. NTIS (US Sales Only) $4.00.

A number of programs and subroutines which are useful for analysis of data from nuclear physics experiments are detailed. Most of them are available from pool pack 005 on the IBM1800 computer. All of these programs are stored there as core loads, and the subroutines and functions in relocatable format. The nature and location of other programs are specified as appropriate. Also included are a number of useful but little-known programs due to other people. (auth)

21050 (CALT-63-229) RESEARCH IN NUCLEAR PHYSICS AT LOW AND INTERMEDIATE ENERGIES, AND X RAYS. Budget Proposal and Progress Report, 1 October 1975–30 September 1976. Boehm, F. (California Inst. of Tech., Pasadena (USA)). 7 May 1975. Contract AT(04-3)-63. 29p. Dep. NTIS $4.50.

A budget is submitted for proposed research in low- and intermediate-energy nuclear physics, as well as for the study of x rays from electronic, muonic, and pionic atoms, for the year October 1, 1975 through September 30, 1976. Brief reports are given for research between April 1974 and April 1975. An item with significant new information is separately listed by title. (RWR)

For a title of an individual paper see: 21157.

21051 (INIS-mf-1755) PROGRESS REPORT, 1974, FOSTER RADIATION LABORATORY, DEPARTMENT OF PHYSICS, McGILL UNIVERSITY. (McGill Univ., Montreal, Quebec (Canada). Foster Radiation Lab.). [nd]. 38p. INIS.

During this past year the Laboratory continued to devote a major portion of its research effort to the study of exotic nuclei lying on the neutron deficient side of the beta stability line. The properties of the large number (8) of nuclides identified in this laboratory in 1973, together with those of many others, have been investigated this year. Much useful systematic information regarding their decay and structure properties has been generated. Also, a good effort has been spent on the study of the beta decay process by means of precision decay half-life measurements. Two more new nuclides have been identified in 1974, and the researchers are anticipating many more to come as the measurement techniques in the laboratory improve. Because of the nature of the research activities in the laboratory, a considerable effort has to be devoted to the development of measurement techniques in order to meet the requirements for dealing with high energy beta and gamma activities with life-times ranging down to milliseconds. During this past year the high speed (transit time 200 ms) pneumatic transport system has been fully automated and has become a regularly used piece of equipment. The superconducting beta ray spectrometer is operational and beta end-point energies up to 10 MeV have been measured. An effort has also been made to convert the mass spectrometer into an isotope separator. A contract for a new R.F. oscillator and its associated power supplied has been issued. The installation of this new oscillator is the first step in our plan to convert the cyclotron to accelerating other light ions with mass ≤ 4. (auth)

21052 (LNF-75/3(R)) INTERMEDIATE NUCLEAR PHYSICS. Malecki, A. (Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati). Jan 1975. 19p. (In Italian). Dep. NTIS (US Sales Only) $4.00.

Intermediate nuclear physics is defined. The advantages to elementary particle physics from the use of nuclear targets and to nuclear physics from the use of high-energy or non-conventional projectiles are briefly considered. The contributions of intermediate nuclear physics to short-range dynamic correlations, study of baryon resonances in nuclear matter, and study of hadron–nucleon scattering are discussed on the basis of experimental data reported in the literature. (32 figures, 52 references). (JSR)

21053 (NP-20480(P8)) IPCR CYCLOTRON PROGRESS REPORT, 1974. Ambe, F.; Odera, M.; Hashizume, A.; Imamura, M.; Sakairi, H. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)). Dec 1974. 184p. Dep. NTIS (US Sales Only) $12.25.

Separate citations were prepared for 33 sections of the report. (MCG)

For abstracts of individual sections see: 19240, 19340–19342, 19404, 19876, 19897, 20311, 20386, 20468–20470, 20784, 20835, 21099–21103, 21138, 21165–21167, 21180, 21200, 21201, 21230, 21248–21250, 21282, 21312, and 21313.

21054 (NP-20494) ANNUAL REPORT, 1974. (European Organization for Nuclear Research, Geneva (Switzerland)). 1975. 222p. European Organization for Nuclear Research, Geneva, Switzerland.

The research includes track chambers, synchrocyclotrons, proton synchrotron, theoretical studies, intersecting storage rings, 300-GeV accelerator, etc. Administration, laboratory organization, publications, etc. are also covered. (DLC)

21055 (ORNL-5025) PHYSICS DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING DECEMBER 31, 1974. (Oak Ridge National Lab., Tenn. (USA)). May 1975. Contract W-7405-eng-26. 277p. Dep. NTIS $7.60.

Reports in the areas of theoretical physics, experimental nuclear physics, nuclear data, accelerator-based atomic physics, accelerators, heavy-ion source program, cold-neutron experiments at the Institute Laue-Langevin, Grenoble, France, electron spectroscopy, hyperfine interactions in solids, high-energy activities, molecular spectroscopy, high-resolution spectroscopy, and interdivisional research are compiled. Separate abstracts were prepared for 57 of the sections. A list of papers, publications, reports, and theses issued during the year is appended. (JSR)

For abstracts of individual sections see: 19379, 19405, 19497, 19814, 20314, 20315, 20387, 20388, 20486, 20786, 20787, 20836, 20918, 20919, 21064, 21104–21108, 21139–21143, 21168, 21169, 21181–21185, 21202–21208, 21231–21238, 21251–21254, 21283, 21284, and 21314–21317.

21056 (PB-229747) GAMMA SPECTRUM CATALOG: RHINO I WITH DECAY SCHEMES AND DETECTION EFFICIENCIES. (Environmental Control Administration, Rockville, Md. (USA). Training Inst.). 1970. 154p. NTIS $10.75.

The report has been prepared specifically for trainees attending environmental radiological health training courses. Included are graphical representations of gamma spectra, nuclear decay schemes, detection efficiencies, and digital representation of gamma spectra. The information is grouped by nuclide and arranged in increasing order of mass number. (GRA)

21057 MICRO- AND MACRO-ASPECTS OF HEAVY ION REACTIONS. Winther, A. (Niels Bohr Institutet, Copenhagen). Fys. Tidsskr.; 72: No. 2-3, 160-169(1974).

The reactions which take place in the collision between two heavy nuclei range from elastic scattering and pure Coulomb excitation below the Coulomb barrier to multinucleon transfer and compound reactions at higher bombarding energies. While Coulomb excitation is one of the simplest reactions met in nuclear physics, the latter reactions involve so many degrees of freedom that a detailed description is hardly of interest. A brief survey of recent work is given. The approximate description of the reactions in terms of a semiclassical picture is discussed. (auth)

Neutron Interactions with Matter

Refer also to abstracts 21103, 21322, and 21363.

21058 (COO-3058-63) APPLICATION OF INTERACTIVE GRAPHICS AND CONTINUOUS SLOWING DOWN THEORY TO THE ASSESSMENT OF NUCLEAR DATA FILES. Danchak, M.; Becker, M.; Moyer, W. R. (Rensselaer Polytechnic Inst., Troy, N. Y. (USA). Div. of Nuclear Engineering). 1972. Contract AT(11-1)-3058. 33p. Dep. NTIS $4.75.

An interactive graphics analysis system was applied to the assessment and modification of the neutron cross section sets for depleted uranium (ENDF/B-II) and iron (1124). The system, RIGAS, allows one to: perform on-line flux calculations based on continuous slowing down theory; instantly compare the plotted results with experiment; and visually and interactively change the slowing down parameters to force agreement with experiment. (11 figures, 2 tables) (auth)

21059 (HEDL-TME-74-45, pp ANC.54-ANC.57) NEUTRON SELF-SHIELDING FROM ANC COUNTING. Helmer, R. G.; Greenwood, R. C. Nov 1974.

In LMFBR reaction rate and dosimetry 9th progress report for period October 1973–May 1974. (Hanford Engineering Development Lab., Richland, Wash. (USA)).

21060 (IFA-MC-22-1975) SNOW - PROGRAMME FOR SOLVING THE BIDIMENSIONAL MULTIGROUP TRANSPORT EQUATION IN THE SN APPROXIMATION. Stancu, M. (Institutul de Fizica Atomica, Bucharest (Romania)). 1975. 19p. (In Romanian). INIS.

The SNOW programme belongs to the mathematician's group Gunther, Kinnebrock, from the Neutron Physics and Reactor Technique Institute in the Nuclear Research Centre, Karlsruhe. The programme is reduced to a shortened form because of memory limits in the IBM 370/135 computer. SNOW stands for an SN solving programme of the bidimensional multigroup transport equation in a geometry, either plane (x,y) or cylinder (r,z) and (r,theta), in isotropic and anisotropic conditions. The present paper offers a general presentation of the code and its usage together with a control example. (auth)

21061 (IKE-6-88) TREATMENT OF ANISOTROPY IN INELASTIC NEUTRON SCATTERING. Roller, D. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Kernenergetik). Feb 1975. 83p. (In German). INIS.

With figs. and tabs., 20 refs. With app.

Until recently, investigations of neutron transport problems were based on the assumption of an isotropic inelastic scattering process in the center-of-mass system. Recent measurements of the inelastic scattering cross-section indicate, however, that there is a structured angular distribution during excitation of discrete levels. The effects of this anisotropy on the normal isotopic mixture of iron is investigated. (GE)

21062 (KFK-2118) D3D: A FORTRAN PROGRAM FOR SOLVING THE THREE-DIMENSIONAL STATIONARY MULTIGROUP DIFFUSION EQUATIONS. Stehle, B. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik). Mar 1975. 90p. (In German). Dep. NTIS (US Sales Only) $7.50.

D3D determines the simple positive and dominant eigenvalue and the related eigensolution of the homogeneous three-dimensional multigroup diffusion equations in Cartesian coordinates (X, Y, Z) and in cylindrical coordinates (THETA, RHO, Z). In addition, the adjoint problem as well as problems with a space-dependent fission spectrum can be solved. Non-diffusion zones are permitted. Upscattering is prohibited. (auth)

21063 (LA-5952) METHOD OF CHARACTERISTICS FOR THE TRANSPORT EQUATION SOLUTION. Carlson, B. G. (Los Alamos Scientific Lab., N. Mex. (USA)). Jul 1975. 30p. Dep. NTIS $4.00.

A method of characteristics is developed for the numerical solution of the multigroup discrete ordinates transport equation. A revised form of the diamond difference method is coordinated with the new approach and some alternate, possibly useful methods are developed. Also, several minor numerical difficulties that occasionally troubled calculations in the past have been resolved. (auth)

21064 (ORNL-5025, pp 112-113) CAPTURE CROSS-SECTION DATA ANALYSIS. Macklin, R. L. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

The nonlinear, least squares program ORGLS2 has been developed for neutron capture data analysis. Samples of fits to data are shown. (2 figures) (SDF)

21065 (RT/PROT-(74)36) RESULTS OF A COMPARISON BETWEEN THE THERMAL NEUTRON FLUX DENSITY STANDARDS OF THE C.S.N. CASACCIA (CNEN) AND OF THE P.T.B. OF BRAUNSCHWEIG (R. F. T.). Laitano, R. F.; Rotondi, E. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Dec 1974. 23p. (In Italian). Dep. NTIS (US Sales Only) $4.25.

An intercomparison of the thermal neutron flux density Standards has been carried out by the P. T. B. of Braunschweig and the Laboratorio di Dosimetria e Standardizzazione of CNEN C. S. N. Casaccia. The quantity which has been compared is the conventional thermal neutron flux density $\eta_{th}\, v_s$, where η_{th} is the neutron density below the cadmium cut-off energy. The measurements have been based on the activation of thin gold foils which were then assessed by $4\pi\beta$-γ coincidence counting. Some systematic uncertainties have been differently estimated in the two laboratories, but the final results agree within the total error. (7 tables) (auth)

21066 (WANL-TMI-1384) DISCRETE DIRECTIONS IN S/sub n/ QUADRATURE. Gray, W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 14 Jan 1965. 11p. Dep. NTIS $4.00.

An interpretation is given to discrete directions in the S/sub n/ quadrature for aid in computer analysis of neutron transport problems. In the DTK code, for example, the S/sub n/ constants are required as input, and angular fluxes appearing in output are detailed according to group, radius, and direction. (7 figures) (SDF)

21067 (WANL-TMI-1576) EFFECT OF CHANGING THE BOUNDARY ENERGY BETWEEN GAM AND TNS. Gibson, G.; Melnick, M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 18 Oct 1965. 5p. Dep. NTIS $4.00.

Results are presented which demonstrate that at least for the special case of neutrons in polycrystalline Be, the flux averaged cross sections which are obtained from the GAM-TNS programs are not sensitive to the choice of energy, E/sub c/, which separates the GAM and TNS energy ranges for 1,125 eV less than or equal to E/sub c/ less than or equal to 2,38 eV. The calculations were carried out for Be at 300 K but this conclusion is probably valid for any attainable temperature. (2 tables) (SDF)

21068 EVALUATION OF THERMAL NEUTRON FLUX IN HYDROGENOUS MODERATORS. Fouad, H. Y. (Atomic Energy Authority, Cairo). Kernenergie; 18: No. 3, 64-65(1975).

The distribution of moderator atom velocity is shown to be a Maxwellian one. The thermal neutron flux is approximated by an equivalent Maxwellian distribution having an effective temperature dependent on the ratio of absorption to scattering present. To obtain such an effective temperature for hydrogenous moderators, the scattering kernel is evaluated, the general balance integral equation reduction to a differential equation is shown, and numerical solutions are derived. (1 table) (auth)

21069 TEMPERATURE DEPENDENCE OF TOTAL COLD NEUTRON CROSS SECTION IN LIGHT WATER AND BENZENE. Stepanov, S. B.; Zhitarev, V. E.; Zelenyuk, F. M.; Krasil'nikov, V. Ya. Sov. At. Energy (Engl. Transl.); 37: No. 4, 1094-1096 (Oct 1974).

Translated from At. Energ. (USSR); 37: No. 4, 351-353(Oct 1974).

The total interaction cross section in both water and benzene was measured for temperatures of 294-523 and 295-543 Kelvins respectively, for neutrons of wavelength 8-14 angstroms. Results indicate a marked rise in the cross sections for water and benzene with temperature and show good agreement with calculations at room temperature. High temperature agreement is not as good. (2 figures, 2 tables) (SDF)

21070 METHOD OF RECURSIVE SUMS AND INTEGRALS FOR SOLVING MULTIGROUP NEUTRON DIFFUSION EQUATIONS. Vasil'ev, Yu. V.; Dymnikov, A. D. Sov. At. Energy (Engl. Transl.); 37: No. 4, 1091-1093(Oct 1974).

Translated from At. Energ. (USSR); 37: No. 4, 350-351(Oct 1974).

A method is presented for calculating the spacial distribution of one-dimensional group neutron fluxes and currents based on writing the solution of a standard system of equations equivalent to the initial system of diffusion equations as nonlinear recursive integrals. Such integrals are in fact nonlinear quadratures. This way of writing facilitates the solution of multizone problems, some problems of optimization, perturbation theory problems, etc. (SDF)

21071 DISCRETE EIGENVALUE OF THE ANGULAR NEUTRON DENSITY WITH ANISOTROPIC SCATTERING. Attia, E. A. (McMaster Univ., Hamilton, Ont.); Harms, A. A.; Kushneriuk, S. A. Can. J. Phys.; 53: No. 8, 825-830(15 Apr 1975).

The discrete eigenvalue appearing in the one speed description of neutron transport is studied for the case of anisotropic scattering. A more complete and corrected tabulation of this parameter is provided and its effect on the neutron density is assessed. (auth)

21072 STUDIES ON NEUTRON THERMALIZATION AND THERMAL NEUTRON FIELD IN THE STANDARD GRAPHITE PILE. Michikawa, T. (Electrotechnical Lab., Tokyo (Japan)). Denshi Gijutsu Sogo Kenkyusho Kenkyu Hokoku; No. 746, 1-95 (Jul 1974). (In Japanese).

The thermal neutron flux $n_{th}v_s$ in the graphite pile was measured by the gold-foil activation method. Various correction factors for the $4\pi\beta$-γ coincidence absolute measurement of the ^{198}Au activity were studied both theoretically and experimentally. The accuracy of the absolute thermal neutron flux was concluded to be ±1.2%. The result was subjected to the first international intercomparison on the thermal neutron flux standards among eleven laboratories under the auspices of the International Bureau of Weights and Measures, which deviated by less than 0.3% from the mean value. The space- and time-dependence of the thermal neutron flux was investigated with a pulse neutron generator, in relation to the phonon frequency distribution in the graphite pile. The time-dependent neutron spectrum was measured with four target materials, Gd, Sm, Cd and $^{10}BF_3$. In order to eliminate the fluctuation of the neutron flux with respect to the time, ratios of the reaction yield were taken as the spectral indicator for six pairs (Gd/^{10}B, Sm/^{10}B, Cd/^{10}B, Gd/Sm, Gd/Cd and Sm/Cd) out of the above four materials. The thermal neutron spectra were thus measured at the distance of 10, 30, 50 and 70 cm from the neutron generator at the pile center. The space- and time-dependent neutron diffusion equation was solved numerically by the finite dif-

ference method for obtaining the thermal neutron energy spectrum in the graphite pile. The inelastic scattering kernels used in the computation were taken from various theoretical phonon frequency distributions for graphite by using the THRUSH code. (JA)

21073 A NUMERICAL METHOD FOR THE TIME-DEPENDENT NEUTRON TRANSPORT EQUATION. Otomo, N.; Inoue, K. (Hokkaido Univ., Sapporo (Japan). Faculty of Engineering). Hokkaido Diagaku Kogakubu Kenkyu Hokoku; No. 72, 117-123(Sep 1974). (In Japanese).

It was once suggested that the time-dependent multi-group neutron transport equation in finite, non-multiplying, isotropic homogeneous media can be solved analytically in a given small time interval and that the solution at any time can be obtained by the iterative procedure. This paper describes a more general formulation. The accuracy of the present method is higher, and it is shown that the well-known direct integration method, in approximation can be obtained from our formulation. (auth)

21074 COMMENTS ON THE COMPARISON OF ENERGY MULTIGROUP TRANSPORT AND DIFFUSION THEORY SOLUTIONS OF THE FAST NEUTRON PENETRATION PROBLEM. Beynon, T. D. (Birmingham Univ., Eng.). J. Phys., D. (London); 8: No. 8, 902-913(1 Jun 1975).

A study is made of the conditions under which multigroup diffusion theory reasonably approximates multigroup transport theory for the fast neutron penetration problem. Defining the probability that a neutron born in a given energy group should suffer its next collision in that group, it is demonstrated that decreasing the size of the energy group decreases the relative accuracy of a diffusion theory calculation. Examples are given for light water and natural iron. (auth)

21075 NEUTRON ANGULAR DISTRIBUTION AND ENERGY SPECTRA FOR VARIOUS SPACE DIRECTIONS IN THE VICINITY OF WATER SHIELDS. Doerschel, B. (Technische Univ., Dresden). Kernenergie; 18: No. 4, 113-119 (Apr 1975). (In German).

Neutron angular distributions and energy spectra for various space directions in the vicinity of water shields have been calculated using the Monte Carlo method. The exit neutron spectrum of a VVR-S type reactor was chosen as the primary spectrum. Studies were made for normal and isotropic incidence of the primary neutrons onto two-dimensional infinite water layers of various thicknesses. The changes in angular and energy distributions may be described by parameters which are discussed as a function of the direction of outcoming neutrons as well as of the angular distribution of the primaries. Moreover, the fractions of thermal, intermediate, and fast neutrons in the total number of passing and reflected neutrons are taken into consideration for describing the energy spectra. From the results obtained conclusions have been drawn for neutron dosimetry in the vicinity of water shields. (auth)

Nuclear Properties and Reactions, $A \leq 5$

Refer also to abstracts 21022, 21098, 21131, 21209, and 21327.

21076 (CEA-CONF-3038) $^{4}He(\gamma,p)T$ REACTION AND GROUND STATE BARYONIC RESONANCE ADMIXTURES. Laget, J. M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire). 1975. 2p. (CONF-750222-4). Dep. NTIS (US Sales Only) $4.00.

From symposium on interaction studies in nuclei; Mainz, F. R. Germany (17 Feb 1975).

In contrast with the D(γ,p)n reaction, the yield of $^{4}He(\gamma,p)T$ does not show an enhancement for photon energies near E_γ = 300 MeV, and the cross section ratio is approximately $^{1}/_{40}$ for E_γ = 280 MeV and θ_p = 90°. A diagrammatic analysis of this reaction is briefly described. (2 figures) (SDF)

21077 (FRNC-TH-522) RADIATIVE COLLISION OF COMPOSITE PARTICLES AT LOW ENERGY. Frois, B. (Paris-11 Univ., 91- Orsay (France)). 1974. 79p. (In French). INIS.

A series of low-energy nucleus-nucleus bremsstrahlung cross-section measurements was carried out. A symmetrical detection geometry was used, where the energy of the photon emitted is low in order to approach the situation in which only the infrared term M^{-1}/omega subsists. The experimental results agree with predictions of the theory reduced to the infrared term alone, within the limits of experimental accuracy (20 percent for ^{3}He-alpha and alpha-alpha, 40 percent for p-p). The alpha-alpha case was studied under conditions where the energy of the two alpha particles of the final state is equal to that of a ^{8}Be resonance in order to see whether any additional effect would occur to amplify the contribution of the rescattering terms. The results showed no appreciable effect. The p-p bremsstrahlung cross-section was calculated by Signell's formula, taking into account the Coulomb interaction in the scattering amplitude calculation. The result obtained is quite different from that of Signell, which shows the prime importance of the Coulomb effect, but as expected the corrections depending on a model are negligible for the p-p case under the experimental conditions used. (FR)

21078 (FUPH-R-118) COMPLEX SEPARABLE POTENTIAL FOR THE α-α INTERACTION. Janus, R. T. (Flinders Univ. of South Australia, Bedford Park. School of Physical Sciences). Mar 1975. 17p. Dep. NTIS (US Sales Only) $4.00.

A non-local complex separable potential is used to fit l = 0, 2, 4, 6, 8, 10 $\alpha-\alpha$ scattering phase shifts (real and imaginary) up to an incident energy of 100 MeV. The calculations take into account the Coulomb interaction exactly, so that the separable potential can be expressed in a Coulomb wave representation. (auth)

21079 (LA-UR-75-1265) PARITY NONCONSERVATION IN TWO-NUCLEON SYSTEMS. Nagle, D. E. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-eng-36. 8p. (CONF-750631-6). Dep. NTIS $4.00.

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975).

The observation of a violation of the parity symmetry in two-nucleon systems implies the presence of a weak hadronic force. The positive effect reported by Lobashov et al. in the reaction np yields d gamma, for the circular polarization of the gamma ray, would imply a large value for the parity nonconserving (PNC) amplitude. A transmission experiment has been undertaken for 15-MeV longitudinally polarized protons on hydrogen. A transmission experiment for 6-GeV polarized protons on Be and on H_2O is in progress at the ZGS at Argonne National Laboratory. The current results of the latter two experiments are summarized, and the relation to theoretical calculations is discussed. (2 figures, 1 table) (auth)

21080 (LA-UR-75-1274) LOW ENERGY PION-NUCLEON AND PION-DEUTERON INTERACTIONS. Burman, R. L. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-eng-36. 12p. (CONF-750631-7). Dep. NTIS $4.00.

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975).

This survey concentrates upon current experiments in the fields of pion-nucleon and pion-deuteron interactions, for low-energy incident pions--below 300 MeV. The discussion is restricted to very recent work. The topics to be covered are: pi/sup +-/p yields pi/sup +-/p, elastic scattering; pi/sup +-/p yields pi/sup +-/p gamma, bremsstrahlung; $pi^{+}d$ yields pp, absorption; pi d yields $pi^{+}d$, elastic scattering; and $pi^{+}d$ yields $pi^{+}pn$, breakup. (14 figures) (auth)

21081 PHOTONEUTRON ANGULAR DISTRIBUTIONS FOR ^{4}He. Irish, J. D. (Toronto Univ.); Berman, B. L.; Thomas, B. J.; McNeill, K. G.; Jury, J. W. Can. J. Phys.; 53: No. 8, 802-811(15 Apr 1975).

Differential cross sections for the reaction $^{4}He(\gamma,n)^{3}He$ have been measured at laboratory angles of 53, 68, 83, 98, 128, and 143 for excitation energies between 22 and 32 MeV by the photoneutron time of flight technique. The photoneutron spectra were used to obtain the angular distribution coefficients in the Legendra series expansion for the differential photoneutron cross sections. Analysis of these coefficients indicates that the photodisintegration process in this nucleus, while dominated by E1 photon absorption followed by channel spin zero (no spin flip) p wave neutron emission, is affected by E1 channel spin one and E2 contributions. In the higher energy region (E > 27 MeV), the amount of E2 absorption observed was approximately 6% of the total and is dominated by the channel spin one E2 matrix element. The total cross section obtained from the measured differential cross sections yields a value of sigma(γ,p)/sigma(γ,n) near unity, in agreement with a calculation of this ratio which requires no charge symmetry breaking component of the nuclear force. (auth)

21082 INVESTIGATIONS OF THE QUASI-FREE SCATTERING AND THE p-n FINAL STATE INTERACTION IN THE REACTION $D(\alpha,p\alpha)n$. Rausch, T. Heidelberg; Univ. Heidelberg (1973). 51p. (In German). INIS.

Thesis.

The reaction $d(\alpha,p\alpha)n$ was investigated in a kinematically complete experiment at an α-energy of 23.7 MeV. The α-particle and the proton were identified in coincidence. The result was that the reaction runs as a step process via ^{5}He and ^{5}Li. Furthermore, the quasi-free scattering of α-particles on the proton of the deuteron was accomplished and the p-n-final-state interaction was investigated. (GE)

21083 STUDY OF THE REACTION ^{3}He(d,p)^{4}He WITH A POLARIZED He-3 TARGET AND 12-MeV DEUTERONS. Lorenzen, K. Hamburg; Univ. Hamburg (1972). 84p. (In German). INIS.

Thesis.

The study reports about the investigation of the ^{3}He(d,p)^{4}He reaction with a polarized target. The analyzer intensity was measured as a function of the scattering angle for a deuteron incident energy of 12 MeV (reaction energy 11.3 MeV). The mean target polarization was 15%. The result of the measurement shows that the highest analyzer intensity is found in the 35° range. At 80° the analyzer intensity changes its sign from negative to positive. (GE)

21084 FINAL STATE INTERACTIONS AND QUASIFREE SCATTERING IN THE REACTION $p_0 + d \rightarrow p_1 + p_2 + n$ AT $E_{p_0} = 16$ MeV. Klein, H. Cologne; Univ. Cologne (1972). 50p. (In German). INIS.

Thesis.

In the $p_0 + d \rightarrow p_1 + p_2 + n$ breakup reaction with $E_{p_0} = 16$ MeV the n–p final-state interaction (FSI) was studied under CM production angles of the singlet deuteron of 60°, 70°, 80°, 90°, 100°, 120° and 140° and quasi-free scattering (QFS) under four pairs of angles. Random-background-free projections along the allowed kinetic curve were obtained from kinetically complete p_1–p_2 coincidence experiments. Comparison with elastic p–d scattering data allowed an absolute normalization to be made. The experimental data show good agreement with Faddeev calculations using separable nucleon–nucleon potentials for the form of intensity distributions. As far as the absolute level is concerned, the experimental FSI data at small (≤ 60°) and large (≥ 120°) production angles are up to 30% below the theoretical values. All QFS data deviate from the theoretical prediction by 10–25%. (GE)

21085 CONSTRUCTION OF A 400 kV ACCELERATOR PLANT WITH A MEASURING APPARATUS FOR THE INVESTIGATION OF NUCLEAR REACTIONS AND TESTING OF THE BARSHAY–TEMMER ISOSPIN THEOREM BY THE REACTION ^{3}H(^{3}He,d)^{4}He AT ENERGIES E(^{3}He) < 840 keV. Quast, U. Bochum, Ger.; Univ. Bochum (1973). 74p. (In German). INIS.

Thesis.

In order to test the Barshay–Temmer isospin theorem by the reaction ^{3}H(^{3}He,d)^{4}He, the angular distributions of the relative differential cross section were recorded at $\bar{E}_z$ = 291, 369, 600 and 800 keV using a solid Ti–tritium target. A d-p discrimination enabled a practically background-free detection of the deuterons. The relative errors were of 0.5% to 3%. A 400-kV Sames accelerator plant was equipped and supplemented by an ion beam conducting system and energy analyzer system. The angular distributions are almost symmetrical around 90° in the center of gravity system at all energies. By expanding according to Legendre polynomials, the small forward–backward asymmetry could be determined, which has its greatest value $W_{max} = -0.013 \pm 0.005$ at $\bar{E}_{^3He} = 291$ keV. The possible causes for the found violation of the Barshay–Temmer theorem are discussed. Using a simple model of the isospin mixture of two states, the results of this work can be described as interferences in the transition over an isospin-allowed $(J^\pi,T) = (1^-,0)$ and an overlapping, forbidden $(2^+,1)$ state in the compound nucleus ^{6}Li whose positions and widths can be estimated to be, from the variation of the cross section for the reaction, $E_x(^6Li)$ approximately 17 MeV, GAMMA approximately 1.6 MeV, $J^\pi = 1^-$, T = 0, and $E_x(^6Li)$ approximately 16.2 MeV, GAMMA approximately 0.5 MeV, $J^\pi = 2^+$, T = 1. (GE)

21086 THE ^{7}Li(α, t)αα AND THE ^{6}Li(α, d)αα REACTIONS AT 29.4 MeV. Matsuki, S.; Yamashita, S. (Nara Women's Univ. (Japan). Dept. of Physics); Fujiwara, N.; Fukunaga, K.; Nguyen, D. C. Bull. Inst. Chem. Res., Kyoto Univ.; 52: No. 1, 202-217(Jul 1974).

Energy spectra of tritons from the ^{7}Li + α reaction and of deuterons from the ^{6}Li + α reaction were measured from 6° to 90° in the laboratory system. Anomalous broad peaks were observed in the energy spectra at forward angles. They cannot be ascribed to resonances in the residual nucleus ^{9}Be. It is suggested that these broad anomalous peaks are due to the sequential decay of the excited state of ^{7}Li and that of the excited state of ^{6}Li. Angular distributions of tritons and deuterons from the reactions ^{7}Li(α, t_0)^{8}Be$_{g.s.}$, ^{7}Li(α, t_1)^{8}Be$_{1.5}$, ^{6}Li(α, d_0)^{8}Be$_{g.s.}$ and ^{6}Li(α, d_1)^{8}Be$_{1.5}$ were measured. These angular distributions were confirmed to be dependent on the spin of the residuals as noticed by Siemssen and Dehnhard. (auth)

21087 STUDY ON THE THREE-NUCLEON REACTION H(d,pp)n AT 12.9 MeV. Schram, P. H. Amsterdam; Vrije Universiteit (Jun 1975). 79p.

Thesis.

During the last years a renewed interest can be noticed in the experimental and theoretical study of the three nucleon problem by means of the deuteron break-up reaction H(d,pp)n. One of the most important reasons for this fact is that the situation with respect to the theoretical description of this reaction has changed considerably. Until a few years ago only simple models were applied to describe the break-up reaction in limited regions of the phase space, for instance the Watson–Migdal model in the region of the final state interaction. These models appeared to be quite unsatisfactory in particular at low bombarding energies, and could be abandoned as soon as obviously more reliable descriptions became available. These new calculations were based on the Faddeev equations, which exactly describe the three body dynamics. They made it possible to study the break-up reaction in the whole phase space even at low projectile energies. More reliable information about the two nucleon interaction (e.g., the off-shell behavior) would come within the range of our possibilities, by comparing the theory with the experiment. Therefore new kinematically complete experiments in which both the outgoing protons of the reaction H(d,pp)n are detected coincidently, were needed to make the most of these possibilities. (auth)

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Refer also to abstracts 20895, 20916, 21085, 21131, 21138, 21140, 21152, 21209, 21304, 21313, and 21316.

21088 (CEA-CONF-3009) BHF-PLUS-REARRANGEMENT CALCULATIONS WITH SOFT-CORE FORCES IN ^{16}O. Padjen, R.; Rouben, B.; Gogny, D.; Pires, P. (Montreal Univ., Quebec (Canada); CEA Centre d'Etudes de Bruyeres-le-Chatel, 92-Montrouge (France); Paris-11 Univ., 91- Orsay (France). Inst. de Physique Nucleaire). 1975. 2p. (In French). (CONF-750233-1). Dep. NTIS (US Sales Only) $4.00.

From conference on Hartree-Fock and self consistent field theories in nuclei; Trieste, Italy (24 Feb 1975).

Second- and third-order rearrangements are included in a self-consistent calculation of the single-particle field of ^{16}O, carried out with G matrices derived from the de Tourreil–Sprung (dTS) and Pires–Gogny–de Tourreil (PGT) soft-core potentials. The effective G matrix was computed to second-order ladders only. Occupation probabilities were treated in an improved manner. The PGT interaction performed slightly better than the dTS. (2 tables) (RWR)

21089 (CEA-R-4641) DIFFERENTIAL CROSS SECTIONS FOR CARBON NEUTRON ELASTIC AND INELASTIC SCATTERING FROM 8.0 TO 14.5 MeV. Haouat, G.; Lachkar, J.; Sigaud, J.; Patin, Y.; Cocu, F. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). Feb 1975. 56p. (In French). Dep. NTIS (US Sales Only) $6.00.

Differential cross sections for fast neutrons scattered by carbon were measured between 8.0 and 14.5 MeV, in steps of 0.5 MeV. The angular distributions for elastic and inelastic scattering to the first excited level in ^{12}C were obtained using the neutron time-of-flight facility of the Centre d'Etudes de Bruyères-le-Châtel tandem van de Graaff accelerator. The uncertainties vary from 7 to 15% for the differential elastic-scattering cross sections and from 8 to 20% for the differential inelastic-scattering cross sections. These data extend to higher energies previous (n,n'γ) measurements on carbon, (between 5.8 and 8.8 MeV) also performed in this laboratory. The comparison of our values with previously reported data, below 9 MeV and around 14 MeV, shows good agreement. No other experimental contribution seems to have been reported, yet, between 9 and 14 MeV. The sum of the integrated cross sections for the elastic and inelastic scattering presented here and the previously published cross sections of the ^{12}C (n,α$_0$) ^{9}Be and ^{12}C (n,n'3α) reactions are compared with the total cross sections measured elsewhere. The excitation functions for the elastic and inelastic (1st excited level) scattering by carbon are also compared with the evaluated values of ENDF/B. III. These evaluated values are not in agreement with our experimental results. (10 figures, 32 tables) (auth)

21090 (COO-1195-342) DIMUON PRODUCTION BY HIGH ENERGY NEUTRONS. Messner, R.; O'Halloran, T.; Wattenberg, A. (Illinois Univ., Urbana (USA)). May 1975. 11p. (CONF-750654-5). Dep. NTIS $4.00.

From international conference on high energy physics; Palermo, Italy (Jun 1975).

Measurements studying the reaction n + Be yields $\mu^+\mu^-$ + X with high-energy neutrons produced by 300-GeV and 380-GeV protons at Fermilab are reported. As a preliminary report has already been published on the 300-GeV data, the emphasis is on the more recent results obtained at higher energies. The detect-

ing apparatus is briefly described; then dimuon mass distributions are presented. Distributions of dimuon pairs as a function of longitudinal and transverse momentum are also shown. It is suggested that the mechanisms involved in the production at lower energies may be different from the ones at these energies. (7 figures) (RWR)

21091 (COO-2130-163, pp 98-132) SELECTED SHORT SUBJECTS. 1973.

In heavy ion lecture series, 1972-73, Volume II.

Eight-particle transfer reactions, nuclear level structure, and other information provided by heavy ion reactions are briefly examined. (30 figures) (SDF)

21092 (COO-2130-163, pp 240-271)) TWO-CENTER SHELL MODEL AND HEAVY-ION SCATTERING. 1973.

In heavy ion lecture series, 1972-73, Volume II.

A two-center shell model is applied to heavy ion scattering. Various aspects of two-center potentials are examined and predictions are compared with experimental data. (16 figures) (SDF)

21093 (HASL-293) TOTAL NEUTRON CROSS SECTIONS FROM 15 MeV TO 25.5 GeV FOR ISOTOPES WITH MASS NUMBERS, 12 LESS THAN OR EQUAL TO A LESS THAN OR EQUAL TO 64. Sanna, R. S. (Energy Research and Development Administration, New York (USA). Health and Safety Lab.). Apr 1975. 22p. Dep. NTIS $4.00.

The need for a compilation of neutron cross-section data above 15 MeV became apparent during projects involving the computation of multisphere neutron spectrometer responses and the use of existing transport codes for calculating atmospheric cosmic rays. A compilation of total neutron cross-section data in the energy range 15 MeV to 25.5 GeV is described for isotopes with mass numbers 12 less than or equal to A less than or equal to 64. (3 figures, 4 tables, 31 references) (auth)

21094 (HEDL-TME-72-90, pp ANL.11-ANL.14) ACCELERATOR-PRODUCED NEUTRON SPECTRA. Dudey, N. D.; Fluss, M. J. Jun 1972.

In LMFBR reaction rate and dosimetry 4th quarterly progress report, March, April, May 1972. (Hanford Engineering Development Lab., Richland, Wash. (USA)).

21095 (IC-74-77) ON ALPHA-CLUSTERING IN O^{16} NUCLEUS. Wadia, W.; Hegab, M. K. H. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1974. 27p. INIS.

The ground-state nuclear density of ^{16}O based on four alpha clusters in a tetrahedral configuration has been investigated. Model-densities for an alpha cluster that would account for the polarizability of the alpha cluster inside the nucleus have been considered. An estimate of the resulting octupole deformation is given by comparison with electron inelastic scattering data and with the lifetime of the first excited 3^- level. (INIS)

21096 (JINR-P4-8837) SCATTERING OF SLOW PI MESONS ON NUCLEI. Arsen'ev, D. A.; Bunatyan, G. G. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 20p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The pi-meson elastic scattering on nuclei has been studied with the help of the effective quasipotential V deduced from the multiple scattering theory by exactly the same method as that used for the description of the bound states of the pi-meson where a good agreement with experimental results has been achieved. The validity of this approach for the description of the pi-meson elastic scattering on various nuclei in the energy range 30-300 MeV is discussed together with some consequences of it. The dependence of the calculated results on the parameters is considered. From the comparison of all the calculated elastic differential cross sections with experimental ones it follows that in the frame of this approach there is no possibility to obtain any reasonable description of the elastic pi-meson scattering on nuclei at large angles. (auth)

21097 (LBL-3633) SINGLE PARTICLE INCLUSIVE SPECTRA RESULTING FROM THE COLLISION OF RELATIVISTIC PROTONS, DEUTERONS, ALPHA PARTICLES, AND CARBON IONS WITH NUCLEI. Papp, J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). May 1975. Contract W-7405-ENG-48. 207p. Dep. NTIS $13.50.

Thesis.

The yields of positive and negative particles resulting from the collision of 1.05 GeV/nucleon and 2.1 GeV/nucleon protons, deuterons, alpha particles, and 1.05 GeV/nucleon carbon nuclei with various targets have been measured. Single particle inclusive cross sections for production of π^+, π^-, p, d, ^3H, ^3He, and ^4He at 2.5^0 (lab) were obtained. How the results bear on the concepts of limiting fragmentation and scaling, the structure of the alpha particle and deuteron, and the possibility of "coherent" production of pions by heavy ions are discussed. (auth)

21098 (LPC-T-74-01) 14-MeV POLARIZED NEUTRON SCATTERING BY OXYGEN-16 AND DEUTERIUM. Phase-Shift Analysis of the Nucleon Deuteron Scattering Between 6 and 36 MeV. Delpierre, P. (College de France, 75- Paris. Lab. de Physique Atomique et Moleculaire; Paris-6 Univ., 75 (France)). 1974. 191p. (In French). INIS.

A 14-MeV polarized neutron generator is described as well as two scattering experiments of these neutrons by deuterium and oxygen-16 which lead to the analyzing power distribution of these two elements. The analyzing power of oxygen-16 is in good agreement with the optical model calculations. A study of the recent neutron–deuteron theories allows comparison with the experimental results. There is a good agreement with the calculations based on the Faddeev equations and a separable nucleon–nucleon potential including S, P, D and ^3S–^3D partial waves. To compare with the proton–deuteron scattering a phase shift analysis is made. It is found that, in the nucleon–deuteron scattering, a neutron has the same behavior as a proton of greater energy. (FR)

21099 (NP-20480(P8), pp 19-23) TRANSFER REACTIONS INDUCED BY ^{14}N ON ^{12}C AT 79 MeV. Motobayashi, T.; Kohno, I.; Nakajima, S.; Yoshie, M.; Katori, K.; Mikumo, T.; Kamitsubo, H. Dec 1974.

In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

21100 (NP-20480(P8), pp 24-26) ANALYSIS OF ELASTIC SCATTERING OF ^{16}O BY ^{19}F. Motobayashi, T.; Imanishi, B. Dec 1974.

In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

21101 (NP-20480(P8), pp 34-39) (^3He, ^3He), (^3He, $^3He'$), AND (^3He, α) REACTIONS ON ^{12}C. Fujisawa, T.; Kamitsubo, H.; Wada, T.; Koike, M.; Tagishi, Y.; Kanai, T. Dec 1974.

In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

21102 (NP-20480(P8), pp 52-54) FULL FINITE-RANGE DWBA CALCULATIONS FOR HEAVY-ION INDUCED TWO-NUCLEON TRANSFER REACTIONS. Takemasa, T. Dec 1974.

In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

21103 (NP-20480(P8), pp 68-72) ROLE OF THE ^{12}C-CORE EXCHANGE IN THE ^{16}O–^{12}C ELASTIC SCATTERING. Yoshida, H. Dec 1974.

In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

21104 (ORNL-5025, pp 44) STUDY OF THE (^6Li,^6He) REACTION AND THE DISTRIBUTION OF GAMOW-TELLER STRENGTH. Goodman, C. D.; Wharton, W. R.; Hensley, D. C. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

For a quasi-elastic (^6Li,^6He) reaction, the Gamow-Teller matrix elements may be obtained from the zero average momentum transfer cross section. With this in mind, a series of experiments has been initiated to determine the conditions under which the quasi-elastic process dominates the cross section in the (^6Li,^6He) reaction. Angular distribution data from ^{14}C(^6Li,^6He)^{14}N suggest that the quasi-elastic process dominates at forward angles for 60 MeV ^6Li. (1 figure) (SDF)

21105 (ORNL-5025, pp 46-49) ANGULAR DISTRIBUTIONS FOR ELASTIC AND INELASTIC SCATTERING OF $^{12}C + ^{12}C$. Stokstad, R. G.; Halbert, M. L.; Hensley, D. C.; Fulmer, C. B.; Raman, S.; Snell, A. H.; Stelson, P. H. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

Angular distributions for elastic and inelastic scattering of ^{12}C by ^{12}C were measured at several energies between 74.2 and 117.1 MeV. Salient features of the experimental results are described. (4 figures) (SDF)

21106 (ORNL-5025, pp 86-87) POPULATION OF HIGH-SPIN STATES IN ^{23}Na THROUGH THE ^{11}B(^{16}O,alpha) REACTION. Gomez del Campo, J.; Gustafson, D. E.; Robinson, R. L.; Stelson, P. H.; Miller, P. D.; Bair, J. K.; McGrory, J. B. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

The average angular distributions for the reaction ^{11}B(^{16}O,alpha)^{22}Na have been measured along with differential cross sections for states excited in ^{23}Na up to 15 MeV. Experimental results were compared with average compound nucleus cross sections calculated with the Hauser–Feshbach expressions

for total and differential cross sections using the code HELGA. (1 figure) (SDF)

21107 (ORNL-5025, pp 116-119) NEUTRON TOTAL CROSS SECTIONS OF FLUORINE AND SILICON. Johnson, C. H.; Larson, D. C.; Harvey, J. A.; Hill, N. W. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

The total cross section of fluorine was measured by the neutron time of flight method. The total neutron cross section for silicon has also been obtained for energies between 5 eV and 700 keV. Good agreement with good-resolution data above 200 keV has been found. (2 figures) (SDF)

21108 (ORNL-5025, pp 234-236) THICK-TARGET NEUTRON YIELDS FROM d + Be AND d + Li AT E/sub d/ equals 40 MeV. Smith, G. J.; Saltmarsh, M. J. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

The neutron spectra from the Li(d,n) and Be(d,n) reactions have been measured at scattering angles between 0 and 20°. The target thicknesses were chosen to be slightly greater than the range of 40-MeV deuterons, the lithium being 1.04 g/cm^2 and the beryllium 1.07 g/cm^2. Time-of-flight measurements were made using a cylinder of NE 213 liquid scintillator 3.97 cm in diameter by 4.45 cm long viewed by an XP1020 photomultiplier tube. (auth)

21109 (ORNL-TM-4823) PRODUCTION OF LOW ENERGY GAMMA RAYS BY NEUTRON INTERACTIONS WITH FLUORINE FOR INCIDENT NEUTRON ENERGIES BETWEEN 0.1 AND 20 MeV. Morgan, G. L.; Dickens, J. K. (Oak Ridge National Lab., Tenn. (USA)). Jun 1975. Contract W-7405-eng-26. 34p. Dep. NTIS $4.75.

Differential cross sections for the production of low-energy gamma rays (<240 keV) by neutron interactions in fluorine have been measured for neutron energies between 0.1 and 20 MeV. The Oak Ridge Electron Linear Accelerator was used as the neutron source. Gamma rays were detected at 92° using an intrinsic germanium detector. Incident neutron energies were determined by time-of-flight techniques. Tables are presented for the production cross sections of three gamma rays having energies of 96, 110, and 197 keV. (14 figures, 3 tables) (auth)

21110 (ORO-4856-13) STUDY OF (p,2p) REACTION ON ^{7}Li AND ^{12}C AT 100 MeV. Technical Report 75-093. Bhowmik, R. K.; Chang, C. C.; Dideiez, J. P.; Holmgren, H. D. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). Jun 1975. 37p. Dep. NTIS $5.00.

The (p,2p) reactions on the target nuclei ^{7}Li and ^{12}C have been studied at 100 MeV bombarding energy. The energies of both the outgoing protons have been measured in coincidence in a coplanar symmetric geometry with good energy and momentum resolution in order to separate the different excited states of the residual nuclei. The experimental data are presented in a form suitable for direct comparison with theory. The distorted wave impulse approximation model (DWIA) can explain the qualitative features of the energy sharing and angular correlation spectra. The detailed quantitative agreement with DWIA is however somewhat poor indicating the necessity of a more exact treatment of the three body reaction. (auth)

21111 (ZFK-277) DIFFERENTIAL NEUTRON EMISSION CROSS SECTIONS σ_{nn} (E$_s$;E,θ) AT 14.6 MeV INCIDENT ENERGY FOR THE ELEMENTS Be, C, Na, Mg, Al, Si, P, S, Ca, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, Se, Br, Zr, Nb, Cd, In, Sn, Sb, I, Ta, W, Au, Hg, Pb, AND Bi. Hermsdorf, D.; Meister, A.; Sassonoff, S.; Seeliger, D.; Seidel, K.; Shahin, F. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Jul 1974. 228p. (In German). Dep. NTIS (US Sales Only) $14.50.

Absolute differential cross sections σ_{nn} (E$_s$; E, θ) are obtained for neutron emission resulting from bombardment of the elements Be, C, Na, Mg, Al, Si, P, S, Ca, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, Se, Br, Zr, Nb, Cd, In, Sn, Sb, J, Ta, W, Au, Hg, Pb and Bi by 14.6 MeV neutrons. The measurements were carried out using a pulsed 14 MeV neutron generator by the method of the time-of-flight spectrometry. Besides the differential emission cross sections σ_{nn} (E$_s$; E, θ), which are given at five scattering angles in the range θ = 40° . . . 150° and in an energy range E = 2.0 . . . 14.6 MeV, the angular distributions σ_{nn} (E$_s$; E...E + ΔE, θ) of emission cross sections integrated over energy intervals of ΔE = 1 MeV width are also presented. For a more lucid arrangement all numerical data of this report are mapped out in the appendix. (auth)

21112 NUCLEAR g FACTOR OF THE 397 KeV STATE IN ^{16}N. Asher, J.; Beene, J. R.; Grace, M. A.; Randolph, W. L.; Start, D. F. H. (Oxford Univ., Eng.). J. Phys., G (London); 1: No. 4, 415-421 (5 May 1975).

The hyperfine interaction in one-electron ^{16}N ions recoiling into vacuum was observed through the perturbation of the ($\alpha\gamma$) angular correlation following the reaction ^{2}H(^{15}O, α)^{16}N*. From the time dependence of this correlation, the g factor of the 1$^-$ level was deduced as g = 1.83 ± 0.13. The same experiment yielded a value for the lifetime of this state of τ_m = 6.5 ± 0.5 ps. (auth)

21113 K-HARMONICS AND SHELL MODEL: TRANSLATIONAL INVARIANT STATES. Letz, H. (Inst. fuer Angewandte Mathematik, Erlangen, Ger.). Lett. Nuovo Cim.; 13: No. 7, 255-258 (14 Jun 1975).

For the treatment of translational invariant states using K harmonics and the shell model, restriction is made to the case of N = 3. One starts with three particles interacting by harmonic forces. The first translational invariant states of three nucleons moving in a fixed oscillator potential with quantum number n = 0 are found. (JFP)

21114 PHOTONEUTRON REACTIONS IN ^{18}O. Allan, J. D. (Trent Univ., Peterborough, Ont.); Jury, J. W.; Johnson, R. G.; McNeill, K. G.; Woodworth, J. G.; Horowitz, Y. S. Can. J. Phys.; 53: No. 8, 786-794 (15 Apr 1975).

Photoneutron energy spectra from ^{18}O have been measured by time-of-flight spectroscopy at bremsstrahlung end point energies from 11 to 18 MeV in 1 MeV steps to obtain the (γ,n$_0$) and (γ,n$_1$) differential cross sections. The ground state photoneutron cross section contains at least 8 major resonances in the region from 10 to 17 MeV and has an average value of 100 μb/sr. The cross section to the first excited state of ^{17}O contains only two major resonances, at 11.4 and 14.4 MeV, and the average cross section in the region from 11 to 16 MeV is about 40μb/sr. Of particular interest is a resonance at 14.4 MeV which appears to reflect a simple excitation of one of the valence neutrons to the 2p$_{\frac{1}{2}}$ state. Analysis of the (γ,n$_0$) and (γ,n$_1$) cross sections for this continuum state leads to estimates of the configuration amplitudes of the 2s$_{\frac{1}{2}}$ and 1d$_{\frac{5}{2}}$ components of this state to be 0.62 ± 0.06 and 0.78 ± 0.08 respectively and the ratio of the $(2s_{\frac{1}{2}})^2$ to $(1d_{\frac{5}{2}})^2$ amplitudes in the ground state of ^{18}O to be 0.39 ± 0.02. (auth)

21115 PHOTONEUTRONS FROM ^{20}Ne. Woodworth, J. G. (Trent Univ., Peterborough, Ont.); Jury, J. W.; Lokan, K. H.; Sherman, N. K. Can. J. Phys.; 53: No. 8, 795-801 (15 Apr 1975).

Photoneutron energy distributions from a target of liquid neon have been measured at 90° by time of flight for bremsstrahlung endpoint energies increasing in 1 MeV steps from 19 to 32 MeV. The differential ground state cross section for the major (91%) isotope ^{20}Ne has been obtained, together with an estimate of the strength of transitions to excited states of ^{19}Ne. Six photoneutron groups are observed, reflecting photon absorption which correlates excellently with existing photoproton data, although the absolute cross section is about 10% smaller. It is noted that the giant dipole resonance, estimated by combining the photoneutron and photoproton data, is centered at approximately 20 MeV, which is anomalously low, and that the integrated cross section up to 28 MeV exhausts only half of the dipole sum. (auth)

21116 ELASTIC SCATTERING OF ALPHA-PARTICLES FROM ^{10}B IN THE ENERGY RANGE FROM 5 TO 30 MeV. Mommsen, H. Bonn; Univ. Bonn. (1971). 57p. (In German). INIS.

Thesis.

The elastic scattering of α-particles on ^{10}B was measured at 10 energies between 5 and 30 MeV over the angular region from 25° to 170°. At foreward angles up to about 100° the angular distributions show a marked diffraction structure, at backward angles an increase of the cross sections is found. From the elastic electron scattering it is found that the ^{10}B-nucleus has a proportionally sharp surface. Therefore an attempt was made to describe the α-^{10}B-scattering data with diffraction models beneath the optical model. The parameters of these models allow determination of the interaction radius of the α-^{10}B-system. For this radius an energy dependence is given. (GE)

21117 STUDY OF THE NUCLEAR STATE STRUCTURE OF THE ^{16}O NUCLEUS UTILIZING THE REACTIONS ^{15}N(τ,d)^{16}O AND ^{17}O(τ,α)^{16}O. Bohne, W. Berlin; Freie Univ. (1971). 105p. (In German). INIS.

Thesis.

The nuclei ^{15}N and ^{17}O were bombarded by ^{3}He-ions of 11 MeV. The emitted charged particles were detected by semiconductor-detectors. By the reactions ^{15}N(^{3}He,d)^{16}O and ^{17}O(^{3}He,α)^{16}O states up to an excitation energy of 14 MeV were investigated. Therefore the angular distributions of deuterons and α-particles were measured for transition to 18 and 15 energy states. For the reaction ^{15}N(^{3}He,α)^{14}N the α-particle angular distribution was determined absolutely for transitions to 13 energy states. For all reactions DWBA calculations were made and absolute spectroscopic factors were determined. To the decision of the optical potential parame-

ters the elastic scattering of ^{3}He on all the target nuclei was measured at 11 MeV. (GE)

21118 THE STEP-DECAY IN THE THREE PARTICLE REACTION $^{10}B(\alpha,2\alpha)^6Li$ AT $E_{\alpha l}$ = 24 MeV. Stehle, H. Cologne; Univ. Cologne (1973). 55p. (In German). INIS.

Thesis.

In the $^{10}B(\alpha,2\alpha)^6Li$ three-particle reaction the step decay over excited levels of ^{10}B was studied with the incident energy of 24 MeV in the range of 4.771 MeV ≤ Ex ≤ 16 MeV in a co-planar, kinematically complete $\alpha 3-\alpha 4$ coincidence experiment under 15 different angular combinations $\theta 3L-\theta 4L$. 17 hitherto unknown T = 0 levels of ^{10}B were determined from the projections along the kinematic curves, and an upper limit was indicated for their α-decay widths. Lower limits for the spins were determined for the 4.771-MeV, 5.922-MeV, 6.024-MeV, 6.134-MeV, 7.62-MeV and 16.00-MeV levels by means of an analysis of the angular distributions of the second decay stage. (GE)

21119 ALPHA-PARTICLE MODEL OF LIGHT NUCLEI. Suzuki, Y. (Niigata Univ. (Japan). Dept. of Physics). Progr. Theor. Phys. (Kyoto); 52: No. 3, 890-902(Sep 1974).

Wave functions based on the alpha-particle model are investigated in a way different from Brink's approach. Relative wave functions between α-particles are constructed from translationally invariant harmonic-oscillator states with use of the fractional-parentage coefficients. We attempt to apply the method developed here to systems of three and four α-particles that are of actual interest. The α-particle model approximated with the orthogonality condition model is shown to be a useful and manageable approach to study nuclear structure, especially α-clustering in nuclei and couplings of clustering states with shell-like states and so on. (auth)

21120 ELASTIC AND INELASTIC SCATTERINGS OF ^{14}N AND ^{12}C PROJECTILES BY ^{12}C, ^{27}Al, ^{28}Si, AND ^{58}Ni. Kohno, I. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)). Sci. Pap. Inst. Phys. Chem. Res. (Jap.); 68: No. 2, 38-63(Aug 1974).

Elastic and inelastic scatterings of ^{14}N and ^{12}C particles by ^{12}C, ^{27}Al, ^{28}Si, and ^{58}Ni at energies from 50 to 90 MeV have been studied. Angular distributions of these elastic scatterings were measured over a laboratory angular range from 7 to 35 degrees at intervals of 1 or 1.5 degrees, and the features of angular distributions were observed to vary with the values of Coulomb parameter (n). These angular distributions were analyzed with an optical model, and the scattering amplitudes of all partial waves were obtained. Angular distributions of inelastic scattering exciting to 2+ and 3− states of ^{12}C and ^{28}Si were measured for $^{12}C + {}^{14}N$, $^{12}C + {}^{12}C$, and $^{28}Si + {}^{12}C$, and mutual excitation to 2 + states of ^{12}C in $^{12}C + {}^{12}C$ and excitation of projectile ^{12}C in $^{28}Si + {}^{12}C$ were also observed. These angular distributions were analyzed with DWBA using optical potential parameters fitting to the elastic scattering data, and the deformation parameters of ^{12}C and ^{28}Si obtained by the analyses were not inconsistent with the values previously reported. (auth)

21121 THE $^9Be(^3He,\alpha)^8Be$ REACTION FROM 1.3 TO 3.2 MeV. Sakamoto, N.; Ogino, K.; Tomita, M.; Inagaki, T. (Kyoto Univ. (Japan). Faculty of Engineering). Bull. Inst. Chem. Res., Kyoto Univ.; 52: No. 1, 146-151(Jul 1974).

The $^9Be(^3He,\alpha)^8Be$ reaction has been studied in the bombarding energy range 1.3 ≤ E(^{3}He) ≤ 3.2 MeV. States at 27.9 and 28.1 MeV were found in the excitation functions for α_0 and α_1, respectively. The 27.9 MeV state was considered to have a natural parity and a large T = 0 component. The 28.1 MeV state was considered to be an unnatural parity state with J ≥ 1 and with a T = 0 component. (auth)

21122 ELASTIC SCATTERING OF ^{16}O ON ^9Be. Takimoto, K.; Fujii, K.; Yamane, I.; Schimizu, J.; Muto, J. (Kyoto Univ. (Japan). Dept. of Physics). Bull. Inst. Chem. Res., Kyoto Univ.; 52: No. 1, 240-245(Jul 1974).

Using the tandem Van de Graaff in Kyoto University, excitation functions of the elastic scattering of ^{16}O on ^9Be at 73.7, 90.0 and 148.6 degrees in the center of mass system have been measured in the energy range E_{lab} = 11.0 − 34.0 MeV. The excitation functions are compared with the optical model calculation using the shallow potential values and or the deeper potential values. Those in the lower energy region are fairly well reproduced with the deeper potential calculation. However, the anomalous structures in the higher energy region could not be explained with our optical model calculation. More complex reactions related to the nuclear structure of the projectile and the target nucleus seems to occur in the higher energy region. (auth)

21123 PROTON INDUCED REACTIONS ON ^9Be FROM 4 TO 6 MeV. Yasue, M.; Ohsawa, T.; Fujiwara, N.; Kakigi, S.; Nguyen, D. C. (Kyoto Univ., Uji (Japan). Inst. for Chemical Research). Bull. Inst. Chem. Res., Kyoto Univ.; 52: No. 1, 177-201(Jul 1974).

Excitation functions and angular distributions for the $^9Be(p,p)^9Be$, $^9Be(p,d)^8Be$, and $^9Be(p,\alpha)^6Li$ reactions have been measured over the range of proton bombarding energies from 4.0 to 6.0 MeV. In the $^9Be(p,p_0)^9Be(g'nd)$, $^9Be(p,p_2)^9Be(2.43)$, and $^9Be(p,\alpha_2)^6Li(3.56)$ reactions, a resonance has been observed at Ep = 4.7 MeV, corresponding to the 10.8 MeV state in ^{10}B. The spin-parity of the 10.8 MeV state in ^{10}B has been determined to be 2^+ by the analysis of the angular distributions for the (p,p_2) and (p,α_2) reactions. In the $^9Be(p,\alpha_1)^6Li(2.18)$ and $^9Be(p,\alpha_2)^6Li(3.56)$ reactions, a resonance corresponding to the 11.5 MeV state of ^{10}B has been observed at Ep = 5.5 MeV. In the $^9Be(p,p_0)^9Be(g'nd)$ and $^9Be(p,\alpha_0)^6Li(g'nd)$ reactions and in the $^9Be(p,p_1)^9Be(1.67)$ reaction, new resonances have been observed at Ep = 4.5 MeV ($Ex(^{10}B)$ = 10.6 MeV) with a width of 200 keV and at Ep = 5.1 MeV ($Ex(^{10}B)$ = 11.2 MeV) with a width of 300 keV, respectively. Besides, a gross bump with a width of about 1 MeV has been found in the $^9Be(p,p_0)^9Be(g'nd)$ reaction around Ep = 4.5 MeV. (auth)

21124 ELASTIC AND INELASTIC SCATTERING OF PROTONS ON ^{14}N IN THE ENERGY REGION OF 10 TO 15 MeV, 2. Theoretical. Oda, Y. Murakami, M. (Tokyo Inst. of Tech. (Japan). Dept. of Physics). J. Phys. Soc. Jap.; 37: No. 2, 299-309(Aug 1974).

The experimental results of the $^{14}N(p,p')^{14}N$ reaction in the energy region of 10 to 15 MeV were analyzed from both points of view of direct and compound-nucleus formation processes. Although the direct reaction theory reproduces the experimental results fairly well, it is not satisfactory in some aspects, especially in its poor reproduction of the rapid changes of the cross sections and angular distribution shapes with proton energy. On the other hand the compound nucleus formation theory with reasonable choices of spins and parities of the levels of the compound nucleus ^{15}O can reproduce well not only this energy dependence but also various aspects of the experimental results. Some theoretical considerations on the symmetry natures of the wave functions of the ^{14}N and ^{15}O states are described. (auth)

21125 INVESTIGATION OF J-DEPENDENCE OF DIFFERENTIAL CROSS SECTIONS OF REACTIONS WITH DEUTERONS ON LIGHT NUCLEI. Zaika, N. I.; Shmarin, P. L. (Inst. of Nuclear Research, Kiev). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 2, 238-243(Feb 1975). (In Russian).

The experimental data are presented for (d,p)-reaction by the nuclei ^{10}B, ^{12}C, ^{13}C, ^{14}N and for (dt)-reaction by the nuclei ^9Be, ^{10}B and ^{12}C the deuterons energy being 13.6 MeV. j-Dependence of differential cross sections of these reactions is discussed. The data are analyzed on the basis of Born's approximation of the distorted waves. It is shown that the method of distorted waves gives a change in angular distributions with a change in j, differing from that experimentally observed. (auth)

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Refer also to abstracts 19365, 21091, 21093, 21096, 21106, 21107, 21111, 21115, 21120, 21159, 21173, 21209, 21221, 21305, 21313, and 21323.

21126 (AECL-5032, pp 10-11) CONSISTENCY OF LIFETIME MEASUREMENTS BY DSAM USING ^{4}He IMPLANTED TARGETS. Forster, J. S.; Ball, G. C.; Davies, W. G.; Mitchell, I. V. (Chalk River Nuclear Labs., Ont.). Jan 1975.

In Physics Division progress report, October 1 to December 31, 1974. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

21127 (ANL/NDM-13) RESPONSE OF SEVERAL THRESHOLD REACTIONS IN REFERENCE FISSION NEUTRON FIELDS. Smith, D. L.; Meadows, J. W. (Argonne National Lab., Ill. (USA)). Jun 1975. Contract W-31-109-Eng-38. 44p. Dep. NTIS $5.25.

Cross sections for (n,p) reactions on ^{27}Al, $^{46,47,48}Ti$, $^{54,56}Fe$, ^{58}Ni, ^{59}Co, and ^{64}Zn and for ^{238}U fission have been measured relative to fission cross sections for ^{235}U or ^{238}U and the results of this work have been reported. These data have been renormalized to accommodate recent revisions of the ^{235}U and ^{238}U fission evaluated cross sections which are accounted for in the ENDF/B-IV files. The response of the renormalized data to two commonly used reference neutron fields have been investigated: i) pure thermal-neutron fission of ^{235}U, and ii) the spontaneous fission of ^{252}Cf. The results of this analysis and a comparison with corresponding recent information from the literature are discussed. Two additional topics are addressed in appendices: i) the preparation and calibration of uranium deposits used in cross section measurements, and ii) errata in some earlier reports from our laboratory on this same general subject. (10 figures, 14 tables) (SDF)

21128 (ANU-P-614) ANALYSIS OF E1 AND E2 RADIATIVE ALPHA-CAPTURE AND GIANT MULTIPOLE RESONANCES. Shikazono, N.; Terasawa, T. (Australian National Univ., Canberra. Research School of Physical Sciences). Apr 1975. 54p. Dep. NTIS (US Sales Only) $5.75.

Experimental data on E1 and E2 radiative alpha-capture are analyzed by taking account of direct and semidirect processes as well as the compound process. Observed excitation functions for these reactions are reasonably well reproduced assuming the reactions take place mainly through giant multipole resonances. It is shown that the compound process dominates in the lower energy region especially for E1 capture whereas in the higher energy region direct and semidirect captures are the major processes especially for E2 capture. Several interesting results are obtained on alpha-particle spectroscopic factors of target ground states and on spreading widths and isospin-mixing coefficients of the giant multipole resonance states. The data are shown to be consistent with the existence of the isoscalar giant quadrupole resonances. The applicability of direct and semidirect capture theories to alpha-capture is examined. (4 tables, 9 figures) (auth)

21129 (BNL-20087) MASSES OF $T_z = +\frac{1}{2}$ NUCLEI IN THE s–d SHELL FROM β-DECAY MEASUREMENTS. Alburger, D. E.; Goosman, D. R.; Davids, C. N.; Hardy, J. C. (Brookhaven National Lab., Upton, N. Y. (USA)). 1975. 9p. (CONF-750648-1). Dep. NTIS $4.00.

From 5th international conference on atomic masses and fundamental constants; Paris, France (2 Jun 1975).

In this work the existence of five new $T_z = +\frac{1}{2}$ nuclides, ^{23}F, ^{29}Mg, ^{31}Al, ^{33}Si, and ^{35}P was established; their properties, including mass values, were determined, along with those of ^{25}Ne and ^{27}Na. Two experimental techniques were used, the "rabbit" transfer of a solid target and the gas transfer system; some novel features of these are described. A β spectrum of ^{33}Si observed in coincidence with 1848-keV γ rays is shown; a mass excess of -20569 ± 50 keV was derived for ^{33}Si. Attempts to produce ^{21}O were unsuccessful. Comparisons of the measured masses of the $T_z = +\frac{1}{2}$ nuclides in the 2s-1d shell with predictions of the Garvey–Kelson mass formulation and with shell-model calculations are shown. The latter produce considerably better agreement with experiment. (3 figures, 1 table) (RWR)

21130 (CENBG-TS-74-3) STUDY AND REALIZATION OF (p,p) ELASTIC SCATTERING EXPERIMENTS. Cressenville, F. (Bordeaux-1 Univ., 33- Gradignan (France). Centre d'Etudes Nucleaires; Bordeaux-1 Univ., 33 (France)). 1974. 51p. (In French). INIS.

This work presents the measurements and the analysis of the elastic scattering differential cross sections in the vicinity of resonant levels. In a first part, the formalism is developed. Experimental techniques and analysis methods are then described. The experimental arrangement allows the simultaneous recording of four spectra. A least-squares program is used to calculate the peak areas and to analyze nonresolved peaks. All these methods were tested on the ^{27}Al(p,p)^{27}Al reaction. Three resonances of this reaction were measured and the spin of resonant levels and total widths were extracted. (FR)

21131 (COO-2130-163) HEAVY ION LECTURE SERIES, 1972–73, VOLUME II. Spangler, J. D.; Seaman, G. G. (eds.). (Kansas State Univ., Manhattan (USA)). 1973. 417p. Dep. NTIS $24.00.

Fifteen lectures on various aspects of heavy ion physics are assembled. A separate abstract is prepared for each. (SDF)

For abstracts of individual papers see: 20808–20810, 20829, 20830, 21091, 21092, 21132, 21133, 21295–21299, and 21392.

21132 (COO-2130-163, pp 24-62) MECHANISMS OF HEAVY-ION REACTIONS: DIRECT OR COMPOUND. 1973.

In heavy ion lecture series, 1972–73, Volume II.

Reaction mechanisms are discussed for the following: ^{16}O(^{6}Li,d), ^{16}O(^{7}Li,t), ^{24}Mg(d,^{6}Li)^{20}Ne, ^{16}O(^{6}Li,^{3}He) and ^{12}C(^{12}C,alpha). (LBS)

21133 (COO-2130-163, pp 63-97) NUCLEAR STRUCTURE INFORMATION FROM HEAVY-ION REACTION STUDIES. 1973.

In heavy ion lecture series, 1972–73, Volume II.

Heavy ion reactions are discussed in their role as a tool for obtaining nuclear level structure information. Details are provided for nuclei near ^{20}Ne. (35 figures) (SDF)

21134 (COO-2171-45) THEORETICAL PREDICTIONS FOR ALPHA PARTICLE SPECTROSCOPIC STRENGTHS. Draayer, J. P. (Rochester Univ., N. Y. (USA). Dept. of Physics and Astronomy). 12 May 1975. Contract E(11-1)-2171. 38p. Dep. NTIS $5.00.

Multinucleon transfers induced in heavy-ion reactions of the type (^{6}Li,d) furnish a selective probe with which to study the interplay between rotational and clustering phenomena so characteristic of the structure of the light sd-shell nuclei. For these nuclei, theoretical predictions for inter-band as well as intra-band transfer strengths can be made using recently tabulated results for angular momentum dependent SU_3 inclusion R_3 relative spectroscopic strengths and angular momentum independent SU_6 inclusion SU_3 coefficients of fractional parentage. The pure SU_3 (oscillator)–SU_4 (supermultiplet) symmetry limit agrees well with results obtained using available eigenfunctions determined in large shell model calculations. In particular, the scalar nature of a transferred "alpha"-cluster insures that the effect of spatial symmetry admixtures in the initial and final states of the target and residual nuclei are minimized. Sum rule quantities provide a measure of the probable effects of symmetry breaking. Strength variations within a band are expected; transfers to core excited states are often favored. Results extracted from exact finite range DWBA analyses of (^{6}Li,d) data on ^{16,18}O, ^{20,21,22}Ne, ^{24,25}Mg show some anomalies in our understanding of the structure and/or reaction mechanisms. (18 figures) (auth)

21135 (HEDL-TME-72-90, pp ANC.25-ANC.26) DECAY SCHEME INFORMATION FOR ANALYSIS OF RADIOCHEMISTRY FOIL MEASUREMENTS. Helmer, R. G.; Greenwood, R. C. Jun 1972.

In LMFBR reaction rate and dosimetry 4th quarterly progress report, March, April, May 1972. (Hanford Engineering Development Lab., Richland, Wash. (USA)).

21136 (HEDL-TME-74-45, pp ANC.49-ANC.53) EVALUATED DECAY SCHEME DATA. Helmer, R. G.; Greenwood, R. C. Nov 1974.

In LMFBR reaction rate and dosimetry 9th progress report for period October 1973–May 1974. (Hanford Engineering Development Lab., Richland, Wash. (USA)).

21137 (IFA-DNBR-10-1974) THE ^{27}Al(n,alpha)^{24}Al CROSS SECTION: EVALUATION OF EXPERIMENTAL DATA (I). Vasiliu, G. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 34p. INIS.

Investigating most of the existing literature on the ^{27}Al(n,alpha)^{24}Mg reaction through 1973, we have done an evaluation of the cross sections for this reaction from threshold to 20 MeV, using the up-to-date standards. A maximum value of 128.13 mb was found for the cross section at 13.52 MeV. Using the evaluated curve, the microscopic integral cross section of the ^{27}Al(n,alpha)^{24}Nd reaction averaged in a ^{235}U thermal fission spectrum was computed on the basis of the simple fission spectrum formula. The value which was found is 0.732 mb for a spectrum "temperature" of 1.305 MeV. In the second part of this work, an analysis of theoretical concepts and calculus of cross section for this reaction and a comparison with the evaluation of experimental data will be published. (auth)

21138 (NP-20480(PS), pp 40-43) STUDY OF RESONANCE STATES INDUCED BY ^{16}O(^{3}He,d)^{17}F AND ^{28}Si(^{3}He,d)^{29}P REACTIONS. Koyama, K.; Nakanishi, N.; Yokomizo, H.; Yamada, S.; Ohnuma, H. Dec 1974.

In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

21139 (ORNL-5025, pp 38-40) STATISTICAL ANALYSIS OF FINE STRUCTURE IN ^{12}C + ^{12}C REACTIONS. Stokstad, R. G. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

The yields of gamma rays from (^{12}C + ^{12}C) reactions have been measured from 3 to 12 MeV (c.m.) in which gamma transitions from the first excited states to the ground state were observed in ^{23}Ne and ^{23}Na. The gross dependence of the cross sections on bombarding energy is being analyzed in terms of various barrier penetration models and the optical model. A statistical analysis has tentatively suggested the existence of nonstatistical resonances in the alpha particle channels. (2 figures) (SDF)

21140 (ORNL-5025, pp 82-85) STATES IN ^{24}Mg POPULATED BY THE ^{10}B(^{16}O,d)^{24}Mg AND ^{12}C(^{16}O,alpha)^{24}Mg REACTIONS. Ford, J. L. C. Jr.; Gomez del Campo, J.; Robinson, R. L.; Stelson, P. H.; Thornton, S. T. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

High spin states in ^{24}Mg populated by the ^{10}B(^{16}O,d) and ^{12}C(^{16}O,alpha) reactions have been investigated, and the data have been used to check the suitability of the Hauser-Feshbach (H-F) technique for determining spin values. It is concluded that the H-F method, coupled with additional information, may be a significant means for locating high spin states. (4 figures) (SDF)

21141 (ORNL-5025, pp 87-89) ^{44}Ca YRAST LEVELS. Kim, H. J.; Robinson, R. L.; Milner, W. T. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

Results of high spin studies on ^{44}Ca as a result of 30-40 MeV ^{18}O bombardment of ^{28}Si are reported. The observed levels compare well with thermal neutron capture results. (2 figures) (SDF)

21142 (ORNL-5025, pp 89-90) LIFETIME OF THE 3.830-MeV STATE OF ^{41}Ca. Kim, H. J.; Robinson, R. L.; Milner, W. T. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

The lifetime of the 3.830 MeV state in ^{41}Ca has been determined from the measured delayed coincidence time distribution between neutrons and gamma rays from the reaction ^{28}Si(^{16}O,2pngamma)^{41}Ca at 40 MeV. The result is 4.16 ± 0.20 nsec. (1 figure) (SDF)

21143 (ORNL-5025, pp 114-116) NEUTRON CAPTURE CROSS SECTION OF ^{33}S TO 850 keV. Halperin, J.; Macklin, R. L. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

The radiative capture neutron cross section has been obtained for ^{33}S in the energy range 2.5 to 850 keV. Energies of observed resonances, capture strength, and total widths from unresolved resonances are tabulated. (1 table, 1 figure) (SDF)

21144 (UCID-16857) IDENTIFICATION OF RADIOACTIVE NUCLIDES PRODUCED WITH IONS ACCELERATED BY THE LLL COLLECTIVE-FIELD ACCELERATOR. Howerton, R. J.; Luce, J. S. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 4 Aug 1975. Contract W-7405-Eng-48. 27p. Dep. NTIS $4.50.

^{12}C and ^{19}F ions accelerated by the LLL Collective-Field Ion Accelerator were impinged upon Al, Cu, Mo, and Ta targets. Gamma-Ray spectroscopic analysis of induced activities resulted in the identification of 22 isotopes not previously reported as having been activated by ^{12}C or ^{19}F induced reactions. Seven isotopes were also identified that had previously been seen by other workers using conventionally produced ion beams. The energy of the ^{12}C particles is inferred to be about 7 MeV per nucleon. The ^{19}F ions have a most probable energy in excess of 80 MeV. (8 tables) (auth)

21145 ABSOLUTE DIFFERENTIAL NEUTRON EMISSION CROSS SECTIONS FOR Na, Mg, Al, Si, P, AND S AT 14 MeV INCIDENCE ENERGY. Hermsdorf, D.; Meister, A.; Sassonoff, S.; Seeliger, D.; Seidel, K. (Technische Univ., Dresden). Kernenergie; 18: No. 3, 83-88(1975). (In German).

By time-of-flight spectrometry absolute differential cross sections have been obtained for neutron emission resulting from the bombardment of the elements Na, Mg, Al, Si, P, and S by 14.6 MeV neutrons. Besides the differential spectra in the energy range E = 2 to 14 MeV at five scattering angles in the range θ = 40° to 150°, the cross sections obtained by integration over energy and solid angle are presented in graphical as well as in parameterized form. The results are discussed and compared with data by other authors. (2 tables, 13 figures) (auth)

21146 SHELL-MODEL CALCULATIONS ON EVEN AND ODD-PARITY STATES IN UPPER SD-SHELL NUCLEI. Hasper, H. (Rijksuniversiteit, Groningen, Netherlands). pp 78-115 of Nuclear Structure Studies on ^{37}K. Hasper, H. (ed.). Groningen; Rijksuniversiteit (6 Dec 1974).

The results of shell-model calculations for even-parity states in nuclei with mass number A = 35 through 39 and for odd-parity states in nuclei with mass number A = 36 through 39 are presented. For the positive-parity states two different residual interactions were used: the MSDI and the MSDI + TENSOR interaction. For positive-parity states, three model spaces were tried: the ($1d_{\frac{3}{2}}$, $2s_{\frac{1}{2}}$, $1d_{\frac{5}{2}}$) configuration, the ($2s_{\frac{1}{2}}$, $1d_{\frac{3}{2}}$, $1f_{\frac{7}{2}}$) configuration and a truncated ($2s_{\frac{1}{2}}$, $1d_{\frac{3}{2}}$, $1f_{\frac{7}{2}}$, $2p_{\frac{3}{2}}$) configuration. Only this last model space was used for calculations of negative-parity states. Calculated and experimental level schemes are compared. Lifetimes, branchings and log ft values are calculated and compared with experimental data for some positive-parity states in ^{38}K. The conclusion is justified that the addition of a tensor force brings about a significant improvement in the calculations. Further it is clear that the extension of the configuration to the fp shell explains a number of "intruder" states for A as low as 36. (auth)

21147 HIGH SPIN NEGATIVE PARITY STATES IN ^{33}P. Nixon, M. R.; Jones, G. D.; Lornie, P. R. G.; Nagel, A.; Nolan, P. J.; Price, H. G.; Twin, P. J. (Liverpool Univ., Eng.). J. Phys., G (London); 1: No. 4, 430-437(5 May 1975).

The states at 4226 keV, 5453 keV and 5638 keV in ^{33}P were studied by means of the reaction ^{30}Si (α, pγ) ^{33}P. New decay modes were observed for the 4226 keV and 5638 keV levels and branching ratios determined. The proton-gamma ray angular correlation of the 1227 keV gamma ray de-exciting the 5453 keV level was measured, using an annular counter telescope to detect the protons, enabling a spin of $^{9}/_{2}$ to be assigned to this level. Simultaneous measurement of singles gamma ray angular distributions and linear polarizations led to a negative parity assignment for this level, and indicated that the 5638 keV level is $11/2^-$. The Recoil Distance Method was used to measure the lifetimes of the 5453 keV (35 ± 7 ps) and the 5638 keV (14 ± 2 ps) levels. The results are compared with the properties of high spin negative parity states in neighbouring nuclei. (auth)

21148 STUDY OF THE ^{28}Si(^{3}He,n)^{30}S REACTION FROM 3.7 TO 4.2 MeV. Kogan, A.; Bevington, P. R. (Case Western Reserve Univ., Cleveland). J. Phys., G (London); 1: No. 4, 422-429(5 May 1975).

The differential cross section for the ^{28}Si (^{3}He, n) reaction has been measured over the range of 3.7 to 4.2 MeV. For both the ground and first excited states of ^{30}S two excitation functions have been obtained, at laboratory angles of 0 and 65 degrees, and three angular distributions, at laboratory average incident energies of 3.94, 4.04 and 4.24 MeV. An acceptable description of the ground-state data has been achieved with an analysis based on a coherent sum of direct-reaction and compound-nucleus amplitudes; this analysis includes a $^{3}/_{2}^-$ resonance at 3.58 MeV (CM), and a $^{5}/_{2}^+$ resonance at 3.85 MeV (CM), with widths of 0.16 MeV and 0.11 MeV, respectively. There is evidence that a resonance at about 3.65 MeV (CM) contributes to the yield of ^{28}Si (^{3}He, n_1). An estimate of 0.1 ± 0.05 with an upper limit of 0.2 ± 0.1 has been extracted for the relative spectroscopic factor for the first excited state of ^{30}S. (auth)

21149 PRECISION MEASUREMENT OF CROSS SECTIONS AT 14 MeV NEUTRON ENERGY. Mannhart, W.; Vonach, H. (Technische Univ. Muenchen, Garching (F. R. Germany). Physik-Department). Z. Phys., A; 272: No. 3, 279-286(Mar 1975). (In German).

5 figs.; 7 tabs.; 76 refs.

Accurate reaction cross sections of ^{24}Mg(n,p)^{24}Na, ^{49}Ti(n,p)^{49}Sc, ^{51}V(n,α)^{48}Sc, ^{65}Cu(n,2n)^{64}Cu, ^{89}Y(n,2n)^{88}Y and ^{107}Ag(n,2n)^{106}Ag (8.3d) have been determined in order to normalize previous measurements of relative excitation functions. Neutrons were produced by the T(d,n)^{4}He reaction, with 163 keV deuterons, at the cascade accelerator of the Institut fuer Radiumforschung und Kernphysik, Vienna. The samples were placed at angles between 50° and 100° relative to the deuteron beam direction. The cross sections were determined relative to the ^{27}Al(n,α)^{24}Na cross section. (GE)

21150 NEUTRON TOTAL CROSS-SECTIONS AT 18.8 eV. Dilg, W. (Technische Univ. Muenchen, Garching (F. R. Germany). Physik-Department). Z. Naturforsch., A; 29: No. 12, 1750-1753 (Dec 1974).

3 tabs.; 23 refs.

Neutron transmission measurements were performed at 18.8 eV neutron energy on F, Al, Sc, V, Fe, Co, Cu, Zn and Nb, in order to accurately determine the "free" scattering cross-sections of these elements. Coherent neutron scattering amplitudes are derived for F, Al, Sc, Fe, Cu, Zn and Nb, using available experimental data of the isotopic and spin-incoherent cross sections. Spin-dependent scattering amplitudes a(I + ½) and a(I − ½) are evaluated for the monoisotopes F, Al, Sc, V, Co and Nb. (GE)

21151 STUDY OF THE DEFORMED NUCLEI ^{24}Mg AND ^{28}Si. Pelte, D. Heidelberg; Univ. Heidelberg (1970). 44p. (In German). INIS.

Thesis.

The static quadrupole moments and E2 transition possibilities of the first excited states of ^{24}Mg and ^{28}Si were measured by coulomb excitation: Q2 = −0.243 b and B(E2, $0^+ \rightarrow 2^+$) = 0.0425 e^2b^2 for ^{24}Mg and Q2 = 0.18 b and B(E2, $0^+ \rightarrow 2^+$) = 0.0317 e^2b^2 for ^{28}Si. The change in sign of the quadrupole moment shows a change in the nuclear formation from positive to negative deformation between ^{24}Mg and ^{28}Si. (GE)

21152 STUDY OF THE REACTIONS ^{28}Si(^{3}He,p)^{30}P AND ^{30}Si(^{3}He,t)^{30}P. Hafner, H. Heidelberg; Univ. Heidelberg (1972). 55p. (In German). INIS.

Thesis.

The reactions ^{28}Si(^{3}He,p)^{30}P and ^{30}Si(^{3}He,t)^{30}P were investigated at 28 MeV bombardment energy with the help of a magnetic spectrograph and angular distribution up to a ^{30}P excitation energy of 5 MeV. At the Buechner magnet spectra and angular distributions were won for the ^{28}Si(^{3}He,p)^{30}P reaction at 16 MeV. For both the reactions microscopic DWBA-calculations were made for the lowest ^{30}P states of positive parity with wave functions by Glaudemans and Wildenthal. (GE)

21153 INVESTIGATION OF PARTICLE–γ ANGULAR CORRELATIONS IN THE REACTION ^{24}Mg(d,pγ)^{25}Mg. Vogler, F. Erlangen, Ger.; Univ. Erlangen-Nuernberg (1972). 61p. (In German). INIS.

Thesis.

At the Erlangen van de Graaff accelerator the reaction ^{24}Mg (d,pγ)^{25}Mg was investigated at 10 MeV. For proton spectroscopy a multi-detector system of 8 silicon surface barrier detectors was used. The double differential cross sections were compared with DWBA calculations. Transitions with an angular momentum transfer l = 0 or 1 can be described well by the DWBA approximation. The l = 4 transitions were analyzed by the method of coupled channels (CCBA). The good agreement with the experiment shows that multi-step processes play a dominant part in these transitions. (GE)

21154 STUDIES OF HIGHLY EXCITED ^{24}Mg STATES WITH THE ^{12}C(^{12}C,nα)^{23}Ne AND ^{12}C(^{13}C,nα)^{23}Ne REACTIONS. Sandoval, A. Heidelberg; Univ. Heidelberg (1973). 65p. (In German). INIS.

Thesis.

For the ^{12}C + ^{13}C system coincidences of neutrons and charged particles were measured at a center-of-mass energy of 14.1 MeV. Only the n–α channel of all output channels n–p, n–α, n–^{12}C and n–^{16}O suitable for measurements was strongly populated and investigated in detail for the first three states of the ^{23}Ne final nucleus. The analysis yielded that the reaction generates a ^{25}Mg compound nucleus which populates a highly excited ^{24}Mg state by neutron evaporation. This state decays to ^{23}Ne 0$^+$, 2$^+$ and 4$^+$ states by α-emission. The populated ^{24}Mg levels are for the most part high-spin states, which are generated by the grazing collision partial waves of the incoming channel in the compound system. The interpretation of these results is discussed in the framework of the statistical model. (GE)

21155 NUCLEAR MAGNETIC MOMENTS OF THE EXCITED $^7/_2^-$ STATES IN ^{41}K, ^{37}K AND ^{37}Ar. Michaelsen, R. Berlin; Freie Univ. (1971). 53p. (In German). INIS.

Thesis.

By the pulsed beam of a 5.5 MeV Van de Graaff accelerator the magnetic moments of the nuclei ^{41}K, ^{37}Ar and ^{37}K were measured in the $^7/_2^-$ excited states: μ = 4.41 nm for ^{41}K, 1.29 MeV; μ = 5.1 nm for ^{37}K, 1.38 MeV; μ = −1.31 nm for ^{37}Ar, 1.61 MeV. At the same time the known lifetimes of these states were determined more exactly. (GE)

21156 PHOTOPROTONS FROM ^{27}Al. Tsubota, H. (Tohoku Univ., Sendai (Japan). Coll. of General Education); Kawamura, N.; Oikawa, S.; Shoda, K. J. Phys. Soc. Jap.; 37: No. 1, 17-23(Jul 1974).

Proton energy spectra of the ^{27}Al(e, e'p)^{26}Mg reaction in the giant resonance region have been measured at 90°. The (γ,p$_0$) and (γ,p$_1$) differential cross sections were obtained. A strong proton group is found at 8.5 MeV in the energy spectra with the electron energies above 22 MeV. This proton group is found to be due to non-ground state transitions. The integrated differential cross sections of the (γ,p$_0$) and (γ,p$_1$) reactions are obtained as 0.45 ± 0.06 and 0.92 ± 0.21 MeV-mb/sr, respectively. The results are compared with those for the neighbouring closed nucleus ^{28}Si. A discussion is made on a direct process. The splitting of the (γ,p$_0$) resonance is studied, and an effect of the isospin rather than the nuclear deformation is suggested. (auth)

Nuclear Properties and Reactions, 39 ≤ A ≤ 58

Refer also to abstracts 19897, 21093, 21111, 21120, 21127, 21128, 21135, 21136, 21141, 21142, 21149, 21150, 21155, 21180, 21209, 21304, 21305, 21312, 21313, and 21322.

21157 (CALT-63-229, pp 12-14) ULTRALOW TEMPERATURE NUCLEAR PHYSICS; TIME REVERSAL. Boehm, F.; Cohen, R. J.; Cheung, N. K.; Henrikson, H. E. 7 May 1975.

In research in nuclear physics at low and intermediate energies, and x rays. Budget proposal and progress report, 1 October 1975–30 September 1976. (California Inst. of Tech., Pasadena (USA)).

21158 (COO-3239-12, pp 34-40) ^{49}Ti(p,2p)^{47}Sc AND ^{48}Ti(p,pp')^{48}Sc CROSS SECTIONS AT 11.5 AND 300 GeV. Yester, M. V. May 1975.

In nuclear chemistry research of high energy nuclear reactions at Carnegie-Mellon University. Progress report, 1974–1975. (Carnegie-Mellon Univ., Pittsburgh, Pa. (USA). Dept. of Chemistry).

21159 (EIR-217) NEUTRON CAPTURE CROSS SECTION MEASUREMENTS IN THE ENERGY REGION FROM 0.01 TO 10 ELECTRON VOLTS. Widder, F. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Apr 1975. 65p. Dep. NTIS (US Sales Only) $6.25.

Absolute neutron capture cross section measurements from 0.01 to 10 eV using a Moxon-Rae detector are described. For the calculation of multiple scattering and gamma attenuation effects in samples new improved methods were developed. Cross section curves were evaluated for the elements Vanadium, Manganese, Cesium, Europium, Dysprosium, Lutetium and Tantalum as well as for the isotopes ^{151}Eu, ^{153}Eu, ^{175}Lu and ^{176}Lu. The accuracy attained is 2–4% from 0.01 to 1 eV and 3–5% above 1 eV. For some resonance cross sections above 4 eV the total error increases up to 10%. (16 figures, 5 tables) (auth)

21160 (FRNC-TH-512) DETERMINATION OF THE TRANSITION PROBABILITIES IN SOME NUCLEI IN THE f–p SHELL, COMPARISON WITH THE SHELL MODEL. Ronsin, H. (Paris-6 Univ., 75 (France)). 1974. 149p. (In French). INIS.

The transition probabilities of a large number of levels in ^{49}Ca, ^{49}Sc and ^{60}Ni were measured and the results obtained are given. For ^{49}Ca the lifetimes were obtained up to 8.5 MeV excitation. Comparison with predicted theoretical values showed the relative validity of various models; and the study of states above 7 MeV, their limits. By studying the lifetimes of the states of ^{60}Ni it was possible to establish the electromagnetic properties (transition diagrams and probabilities) of all the levels up to 5.6 MeV excitation, and thus demonstrate the lack of internal coherence of BCS–RPA-type calculations. To describe the core polarization and obtain the high transition probabilities of the 2 states it was necessary to increase the configuration space, the result being that it was impossible to reproduce correctly the energy spectrum. The Doppler effect attenuation method was used to determine the lifetimes. The results given by the different slowing-down approximations used were compared by direct numerical integration of the cross-section curves of absorption in matter. Corrections were made for the detection conditions and the resulting error was estimated. (FR)

21161 (HEDL-TME-72-90, pp BNL.1-BNL.11) EVALUATED CROSS SECTION LIBRARIES. Magurno, B. A. Jun 1972.

In LMFBR reaction rate and dosimetry 4th quarterly progress report, March, April, May 1972. (Hanford Engineering Development Lab., Richland, Wash. (USA)).

21162 (HEDL-TME-72-90, pp HEDL.22-HEDL.25) REACTION CROSS SECTIONS. McElroy, W. N.; Simons, R. L.; Kellogg, L. S. Jun 1972.

In LMFBR reaction rate and dosimetry 4th quarterly progress report, March, April, May 1972. (Hanford Engineering Development Lab., Richland, Wash. (USA)).

21163 (IC-74-73) ON THE STRUCTURE OF LOW-LYING LEVELS IN ^{56}Ni. Sharma, S. K. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1974. 7p. INIS.

It is shown possible to understand the structure of the low-lying states in the nucleus ^{56}Ni, in a simple way, in terms of the Hartree–Fock intrinsic states resulting from the Kuo–Brown effective interaction for the 2p1f shell, modified slightly so as to satisfy certain constraints imposed on it by the B(E2) (O yields 2) systematics in the shell. (INIS)

21164 (IFVE-ORZ-74-3) STUDY INTO THE INTERNUCLEAR CASCADE TRANSITION REGION IN IRON FOLLOWING 50 GeV/c PROTON IRRADIATION. Britvich, G. I.; Lebedev, V. N.; Lukanin, V. S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov, Inst. Fiziki Vysokikh Ehnergij). 1974. 8p. (In Russian). INIS.

Experimental values were obtained for cross sections characteristic of an internuclear cascade for secondary hadrons with energies greater than 20, 40, and 600 MeV. Secondary radiation was measured by activation foils of polyethylene, aluminum, and copper in a stable installation, 40 cm thick, irradiated by a 1- by 1-cm^2 proton beam with a 50-GeV/c pulse. (1 figure, 2 tables) (tr-auth)

21165 (NP-20480(P8), pp 6-11) INCIDENT ENERGY DEPENDENCE OF OPTIMUM Q-VALUES IN MULTINUCLEON TRANSFER REACTIONS INDUCED BY HEAVY IONS. Mikumo, T.; Kohno, I.; Katori, K.; Motobayashi, T.; Nakajima, S.; Yoshie, M.; Kamitsubo, H. Dec 1974.

In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

21166 (NP-20480(P8), pp 48-51) ANALYSES OF Cr(^{3}He,d)Mn REACTIONS AT 29.29 MeV. Nakanishi, N.; Takeda, S.; Ohnuma, H.; Yamada, S.; Sakaguchi, H.; Nakamura, M.; Takeuchi, S.; Koyama, K. Dec 1974.

In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

21167 (NP-20480(P8), pp 73-75) LIFETIME MEASUREMENT OF THE 6^+(2976 keV) STATE IN ^{46}Ca AND E2 EFFECTIVE CHARGES IN $(lf_{\gamma})^{12}$ NUCLEI. Kutschera, W.; Sprouse, G. D.; Ikezoe, H.; Yamazaki, Y.; Nomura, T. Dec 1974.

In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

21168 (ORNL-5025, pp 61-64) STUDY OF THE GIANT RESONANCE REGION AND BOUND STATES IN ^{58}Ni, USING INELASTIC SCATTERING OF POLARIZED PROTONS. Kocher, D. C.; Bertrand, F. E.; Gross, E. E.; Newman, E. May 1795.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

Studies of the giant resonance region of the nuclear continuum have continued with a series of experiments of ^{58}Ni(p,p') using a 60 MeV polarized proton beam. Data was taken to check previously measured analyzing powers for the E2 resonance. To check theoretical predictions (DWBA), data were also obtained for analyzing powers for low lying bound states with known spin and parity. The present status of measurement and analysis of the E2 resonance, bound states, and elastic scattering is summarized. (4 figures) (SDF)

21169 (ORNL-5025, pp 64-65) ISOLATION OF THE GIANT QUADRUPOLE RESONANCE IN ^{58}Ni VIA DEUTERON INELASTIC SCATTERING. Bertrand, F. E.; Newman, E.; Kocher, D. C.; Chang, C. C. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

The giant resonance region of ^{58}Ni has been studied using the (d,d') reaction with 70 and 46 MeV deuterons. The resonance cross sections for (d,d') are generally more accurate than those obtained by other inelastic scattering experiments due to the absence of the E1 resonance and the relatively large ratio of resonance to continuum cross section. Comparison of data with DWBA provides strong additional evidence for identification of the E2 resonance. (2 figures) (SDF)

21170 MOMENT OF INERTIA DURING THE DE-EXCITATION OF THE COMPOUND NUCLEUS. Demeyer, A. (Univ. Claude Bernard, Lyon); Chevarier, N.; Chevarier, A.; Magda, T.; Plostinaru, D. Lett. Nuovo Cim.; 13: No. 6, 201-208(7 Jun 1975).

The (α,n) reactions were chosen to study the moment of inertia during the de-excitation of the compound nucleus. The isomer ratio analysis, in its Fermi-gas formalism, is correct when the level density is high enough, as for odd nuclei in the midshells. A microscopic calculation such as that proposed previously must be very useful to investigate whether such drastic parity effect can be explained. (JFP)

21171 EVEN PARITY STATES OF ^{46}Ti. Skouras, L. D. (Democritus Nuclear Research Center, Athens). J. Phys., G (London); 1: No. 4, 438-445(5 May 1975).

The even parity spectrum of ^{46}Ti is calculated in the augmented basis of 6-particle and 8p-2h configurations. A deformed scheme is adopted and only the states that arise from the lower intrinsic wavefunctions are considered. Apart from the $2_2 \rightarrow 2_1$ mixing ratio the theoretical results are found to be in good agreement with experiment for both energy levels and transition rates. (auth)

21172 THERMAL NEUTRON ACTIVATION CROSS SECTIONS WITH HIGH ACCURACY. Mannhart, W. (Technische Univ. Muenchen, Garching (F. R. Germany). Physik-Department). Z. Phys., A; 272: No. 3, 273-277(Mar 1975). (In German).

1 fig.; 5 tabs.; 45 refs.

Activation cross sections have been determined for some isotopes which are important for flux monitoring or which have rarely been measured so far. The following reactions were investigated: ^{45}Sc(n,γ)^{46}Sc, ^{115}In(n,γ)^{116m}In, ^{139}La(n,γ)^{140}La, ^{179}Hf(n,γ)^{180m}Hf and ^{180}Hf(n,γ)^{181}Hf. The activations were performed in a purely thermal neutron spectrum (Cd ratio > 1,100) at the FRM. The isotopes were irradiated in the form of foils sandwiched with gold foils as flux monitor. The flux ratio between measuring and monitor foil was corrected for self-absorption, self-scattering and scattering from neighbouring foils. The total error of the cross sections measured is smaller by a factor of 5 to 10 compared to previous data. An analysis of all contributions to the total error is given in detail. (GE)

21173 STATISTICAL MODEL OF NUCLEAR REACTIONS AS A SPECTROSCOPICAL TOOL. Hasper, H. (Rijksuniversiteit, Groningen, Netherlands). pp 44-77 of Nuclear Structure Studies on ^{39}K. Hasper, H. (ed.). Groningen; Rijksuniversiteit (6 Dec 1974).

Results are presented of a comparison between average yields to levels in ^{39}K populated in the ^{42}Ca(d,α) reaction, and Hauser-Feshbach calculations. Fluctuation analysis was also carried out on the yield curves. This provided an objective basis for the assignment of errors to the average yields. The conclusion is reached that this type of comparison can be a useful supplementary tool in spin-parity assignment. (auth)

21174 STRUCTURE OF ^{54}Mn FROM THE ^{54}Cr(p,nγ)^{54}Mn AND ^{51}V(α,nγ)^{54}Mn REACTIONS. Alenius, N. G.; Arnell, S. E.; Selin, E.; Stankiewicz, O. (Chalmers Univ. of Tech., Goteborg). Nuovo Cim., 27A: No. 3, 249-276(1 Jun 1975).

The properties of excited states of ^{54}Mn formed in the ^{54}Cr(p,nγ)^{54}Mn reaction at 3.0 to 4.3 MeV incident-proton energy and in the ^{51}V(α,nγ)^{54}Mn reaction at 7 to 15 MeV incident α-energy were studied by means of γ-ray spectroscopy. From measurements of yield functions and angular distributions spin assignments of 6 and 5 are proposed for the 1073 and 1173 keV states. New high spin states are found at 1784 keV (7^+), 1925 keV (7), 2856 keV (8), 3237 keV (8, 9) and 3244 keV (9^+). The new high spin states are interpreted as spherical positive-parity states predicted by shell theory based on configurations outside the ^{48}Ca core coexisting with states resulting from a breaking of the ^{48}Ca neutron core. The positions of the states considered as belonging to the former group agree well with theoretical predictions. The states considered to be associated with the breaking of the neutron core follow the J(J + 1)-rule. (auth)

21175 STUDY OF T > STATE BY (e, e'p) REACTION. Otkawa, S.; Saito, T.; Suzuki, A.; Tamae, T.; Uegaki, J. (Tohoku Univ., Sendai (Japan). Lab. of Nuclear Science). Kakuriken Kenkyu Hokoku; 7: No. 1, 73-84(Jun 1974). (In Japanese).

The cross section of (e, e'p) reaction and the spectra of emitted protons were measured for ^{44}Ca, ^{140}Ce, ^{159}Tb and ^{165}Ho. Electron beam was obtained with a linear accelerator. For ^{44}Ca, (γ, p), (γ, p_0) and (γ, α_0) cross section were obtained. The experimental values of cross-sections were discussed from the viewpoint of isospin splitting. The result indicates the effect of neutron excess on the cross sections. The intensity ratio of upper and lower peaks can be explained by considering the isospin mixing of the T < state. The cross section of ^{140}Ce (γ, p) reaction was measured. The measured energy region was above 5.5 MeV. The (γ, p) cross section was obtained from a measured yield curve by using a virtual photon spectrum and Cook's least structure method. Peaks were seen at the energy of 16.5, 18, 20.7, and 24.5 MeV. Discussion will be made after the next experiment. Measurement of yield curves for the (e, e'p) reaction of ^{159}T6 and ^{165}Ho was made to increase data concerning the exciting energy in the isobaric analog states (IAS) of deformed nuclei. The exciting energy in IAS measured was lower than theoretical values by about 500 KeV in the case of ^{159}T6 and by about 650 KeV in ^{165}Ho. (JA)

21176 ISOSPIN EFFECTS IN COMPOUND-STATISTICAL NUCLEAR REACTIONS. Wiley, J. R. Lafayette, IN; Purdue Univ. (1974). 94p. University Microfilms Order No. 74-26,796.

Thesis (Ph. D.).

The compound nuclei ^{49}V, ^{52}Cr, ^{55}Mn, ^{56}Fe, ^{60}Ni, ^{63}Cu, ^{64}Zn, ^{66}Zn, and ^{69}Ga were formed by 14 MeV proton bombardment of the appropriate targets. The same compound nuclei were formed at matching excitation energies by irradiation of the appropriate targets by 12-19 MeV alpha particles. ^{69}Ga was also formed with 11, 12, and 16 MeV protons and 13.9, 14.9, and 19.1 MeV alpha particles. Energy spectra and angular distributions of protons and alpha particles emitted by the decay of these compound nuclei were measured. Integrated cross sections were determined from the experimental spectra. Cross sections of the (p,p') reactions were corrected for pre-compound effects. The extent of isospin mixing between the T/sub less than/ and T/sub greater than/ states of the compound nuclei were determined by comparison of the quantity sigma/sub (p,p')/sigma/sub (alpha,alpha')// sigma/sub (p,alpha)/sigma/sub (alpha,p)/ with theory. The nine compound nuclei formed with 14 MeV protons and 12-19 MeV alpha particles all gave mixing fractions in the range of 0.4 +- 0.2. The mixing fractions were used for the first time to estimate values of the mixing widths. These widths were found to range from 1 to 30 KeV and are in very good agreement with values of the Coulomb matrix elements which have been estimated from beta-decay studies to range from 1 to 40 keV. The first study of the energy dependence of isospin mixing in compound statistical reactions was conducted. The mixing fraction was observed to increase with excitation energy and ranged from 0.03 to 0.29. The corresponding mixing widths increased from 0.2 to 16 keV. This result suggests that the Coulomb matrix elements responsible for isospin mixing may be energy dependent. (auth)

Nuclear Properties and Reactions, 59 ≤ A ≤ 89

Refer also to abstracts 19365, 19812, 20819, 21093, 21096, 21097, 21111, 21127, 21135, 21136, 21144, 21149, 21150, 21160, 21170, 21176, 21199, 21209, and 21214.

21177 (AECL-5032,pp 17-18) PREDICTED PROPERTIES OF MEDIUM MASS N APPROX. = Z NUCLEI. Hardy, J. C. (Chalk River Nuclear Labs., Ont.). Jan 1975.
In Physics Division progress report, October 1 to December 31, 1974. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

21178 (CEA-CONF-3012) (^{16}O,^{14}C) TWO PROTON TRANSFER REACTION INDUCED TWO STEP PROCESSES IN THE GERMANIUM TARGET ISOTOPES. Cobern, M.; Lemaire, M. C.; Low, K. S.; Mermaz, M. C.; Sztark, H. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Physique Nucleaire). 1975. 2p. (CONF-750118-4). Dept. NTIS (US Sales Only) $4.00.
From international workshop III on gross properties of nuclei and nuclear excitations; Hirschegg, Kleinwalsertal, Austria (13 Jan 1975).
The angular distributions of the (^{16}O,^{14}C) two proton transfer reaction on ^{72}Ge, ^{74}Ge, and ^{76}Ge have been measured at 56 MeV ^{16}O incident energy between 13 and 70 degrees in the laboratory frame. The elastic and first 2^+ inelastic cross sections have also been measured for ^{72}Ge and ^{74}Ge target nuclei. A coupled channel analysis yielded optical model parameters. It has been found that the dominant contribution for the 0^+ and 2^+ transitions is the direct route interferring with the indirect transition resulting from the core excitation of the residual nucleus. (1 fig) (SDF)

21179 (COO-3239-12, pp 51-56) $^{65}Cu + ^{12}C$ REACTION AT 126 MeV. Spector, R. J. May 1975.
In nuclear chemistry research of high energy nuclear reactions at Carnegie-Mellon University. Progress report, 1974-1975. (Carnegie-Mellon Univ., Pittsburgh, Pa. (USA). Dept. of Chemistry).

21180 (NP-20480(P8), pp 44-47) $^{58\ 60\ 62\ 64}Ni(^3He,d)^{59\ 61\ 63\ 65}Cu$ REACTIONS AND THE CORRELATION BETWEEN UNBOUND STATES AND RESONANCE STATES. Sakaguchi, H.; Nakamura, M.; Takeuchi, S.; Nakanishi, N.; Takeda, S. Dec 1974.
In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

21181 (ORNL-5025, pp 90-91) HIGH-SPIN YRAST CASCADE IN ^{60}Ni. Kim, H. J.; Ballini, R.; Delaunay, B.; Delaunay, J.; Fouan, J. P.; Pichevar, M. May 1975.
In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).
High spin states in ^{60}Ni have been investigated via the ^{58}Ni(alpha,2pgamma)^{60}Ni, ^{52}Cr(^{12}C,2pgamma)^{60}Ni, and ^{46}Ti-(^{18}O,2pgamma)^{60}Ni reactions. The level scheme determined from these measurements is presented. (SDF)

21182 (ORNL-5025, pp 93-95) LEVELS IN ^{72}Se OBSERVED VIA IN-BEAM GAMMA-RAY SPECTROSCOPY IN THE ^{58}Ni ^{58}Ni(^{16}O,2p) REACTION. Crowell, H. L.; Collins, W. E.; Hamilton, J. H.; Robinson, R. L.; Sayer, R. O.; Kim, H. J. May 1975.
In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).
Levels in ^{72}Se were observed via in-beam gamma spectroscopy following the ^{58}Ni(^{16}O,2p) reaction. Spectra and partial energy level schemes are shown. (3 figures) (SDF)

21183 (ORNL-5025, pp 95-96) LIFETIMES OF HIGH-SPIN STATES IN ^{72}Se. Hamilton, J. H.; Crowell, H. L.; Robinson, R. L.; Collins, W. E.; Ramayya, A. V.; Ronningen, R. M.; Singhal, N. C.; Kim, H. J. May 1975.
In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).
High spin states in ^{72}Se populated in the ^{58}Ni(^{16}O,2p) reaction have been investigated. Preliminary results are given for mean lifetimes of the 6^+, 8^+, 10^+, and 12^+ states. These represent the first lifetime measurements for such high spin states in lighter mass nuclei. (3 figures) (SDF)

21184 (ORNL-5025, pp 97-98) MEAN LIFE OF THE 0_2^+ STATE AT 854 keV IN ^{74}Se. Ramayya, A. V.; Ronningen, R. M.; Hamilton, J. H.; Lourens, W.; Carter, H. K.; Sayer, R. O. May 1975.
In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).
In order to investigate the coexistence of spherical and deformed shapes in ^{74}Se, measurement of the lifetime of the 0_2^+ state has been carried out. Comparison of ^{74}Se energy levels with those predicted for spherical and rotational models is presented. (2 figures) (SDF)

21185 (ORNL-5025, pp 98-99) ABSOLUTE CROSS SECTIONS FOR THE ^{63}Cu(^{16}O,X) REACTIONS. Wells, J. C. Jr.; Robinson, R. L.; Kim, H. J.; Ford, J. L. C. Jr. May 1975.
In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).
Absolute cross sections for reaction products in the 38.5 to 51.0 MeV ^{16}O bombardment of ^{63}Cu are reported. Gamma spectroscopy was used to identify the products. Results are compared with predictions for the statistical decay from compound nuclei. (3 figures) (SDF)

21186 (RD/B/N-3233) EVALUATION OF EFFECTIVE NEUTRON ACTIVATION CROSS-SECTION OF ^{59}Co IN VARIOUS SPECTRA. Longworth, J. P. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Apr 1975. 12p. Dep. NTIS (US Sales Only) $4.00.
The activation cross-section of ^{59}Co has a resonance for neutrons of energy in the range 101 to 167 eV which is strong enough to contribute significantly to the ^{59}Co (n, γ) ^{60}Co reaction rate in most spectra. In particular, the spectrum averaged cross-section, $\bar{\sigma}$, may vary by an order of magnitude in apparently similar spectra of the fast reactor type. In this note it is shown that $\bar{\sigma}$ is typically 20 barns, 0.65 barns and 0.068 barns in thermal, CFR breeder and CFR core spectra respectively. As a rule of thumb, for non-thermal spectra where the percentage of the flux in the resonance energy group is more than 0.5%, $\bar{\sigma}$ in barns is numerically approximately equal to this percentage, which must therefore be known as accurately as $\bar{\sigma}$ is required. (5 figures, 2 tables) (auth)

21187 MEASUREMENT OF THE INTERNAL BREMSSTRAHLUNG SPECTRUM OF ^{90}Y. Power, M. S.; Singh, M. (Punjabi Univ., Patiala, India). J. Phys., G (London); 1: No. 4, 453-460 (5 May 1975).
The internal bremsstrahlung (IB) spectrum, photon yield and IB energy per beta disintegration from ^{90}Y have been measured in an energy range of 550 to 1990 keV with a scintillation spectrometer. Experimental results are compared with the presently available theoretical distributions of IB photons. It is observed that the experimental results are higher than the modified KUB, Lewis and Ford, and Ford and Martin distributions over a wide energy range, except for their agreement with the latter two distributions in an energy range of 1690 to 1990 keV. The experimental results show equally good agreement over a wide span of energy with Felsner and Janouch and Havranek distributions. It is pointed out that although the latter distribution considers a vector-axial vector interaction for beta decay it is necessary to incorporate the effects of nuclear Coulomb fields and detour transitions to this theory for a correct assessment. The existing theoretical situation does not allow any conclusions to be drawn regarding the contributions of detour transitions to the IB spectrum of ^{90}Y. (auth)

21188 SMALL ORDER DEVIATION OF ^{91}Y BETA SPECTRUM. Rao, P. M.; Rao, C. N.; Rao, B. M.; Reddy, K. V. (Andhra Univ., Waltair). J. Phys., G (London); 1: No. 4, 461-466(5 May 1975).
The beta spectrum of the 58d ^{91}Y isotope has been analysed with a thoroughly tested intermediate image beta ray spectrometer. The shape factor analysis was performed with exact Fermi functions from the table of Bhalla and Rose and screening corrections due to Buhring. The end point energy of this ($\frac{1}{2}^- \rightarrow \frac{1}{2}^+$) transition was found to be (1545 ± 2 keV). The experimental shape factor was weighted least square fitted to a linear correction term C(W) = k(1-0.009W) and a hyperbolic term C(W) = k(1-0.028/W). This present measurement is clearly in disagreement with the large hyperbolic form reported by Langer et al. (auth)

21189 DECAY OF $^{68}Cu^m$ (3.75 MIN) AND $^{68}Cu^g$ (30s). Tikku, V. K.; Mukherjee, S. K. (Saha Inst. of Nuclear Physics, Calcutta). J. Phys., G (London); 1: No. 4, 446-452(5 May 1975).
The decay of the $^{68}Cu^{m+g}$ has been investigated using a large volume Ge(Li) spectrometer. The ^{68}Cu activities were produced by irradiating enriched ^{68}Zn as well as spectroscopically pure Zn targets with fast neutrons. The isomer is seen to decay 91% via the isomeric transitions to $^{68}Cu^g$. The spin-parity of $^{68}Cu^g$ has been established to be 1^+ and the excited levels in ^{68}Cu have been interpreted as 2^+ (84.6 keV), 3^- (610.5 keV) and 6^- (721.5 keV). The results are incorporated into a revised decay scheme of $^{68}Cu^{m+g}$. (auth)

21190 RESONANCE BEHAVIOR OF A DISTURBED $\gamma-\gamma$ - ANGULAR CORRELATION IN A MAGNETIC FIELD. Borchert, I. Goettingen, Ger.; Univ. Goettingen (1973). 29p. (In German). INIS.

Thesis.

Experimentally and theoretically the influence of an external magnetic field on the angular correlation of two gammas was investigated. The angular correlation anistropy of the γ-γ-cascade of ^{75}As with the energies 121.0 and 279.5 keV is measured as function of a homogeneous magnetic field. At integral measuring method the anisotropy shows a resonance behaviour around the zero magnetic field. This is caused by crossing hyperfine structure levels and interference terms of the correlation function. (GE)

21191 THE DECAY OF ^{76}Br. Nagahara, T.; Nakayama, H. (Rikkyo Univ., Yokosuka, Kanagawa (Japan). Inst. for Atomic Energy); Ruan, J. Z.; Ishizuka, Y.; Okano, M. J. Phys. Soc. Jap.; 37: No. 1, 1-9(Jul 1974).

The decay of ^{76}Br was investigated using a spectrometer of a Ge(Li) detector placed at the center of a large annular NaI(Tl) crystal, which was used either as a Compton suppression spectrometer or as a pair spectrometer. The energies and relative intensities of 103 gamma rays were determined from the singles gamma-ray spectrum. Gamma-gamma coincidence experiments were performed with Ge(Li)-NaI(Tl) detectors. Of the observed transitions, 96 are placed in a decay scheme with 32 excited levels in ^{76}Se at 559.1, 1122.3, 1216.1, 1330.9, 1689.0, 1787.8, 2127.6, 2171.1, 2374.0, 2429.2, 2515.4, 2629.1, 2655.6, 2670.2, 2950.5, 3069.8, 3160.1, 3351.0, 3459.7, 3556.5, 3604.0, 3669.0, 3913.1, 3929.0, 3970.5, 4020.2, 4084.4, 4172.6, 4198.8, 4215.7 and 4604.1 keV. (auth)

Nuclear Properties and Reactions, 90 ≤ A ≤ 149

Refer also to abstracts 19365, 20487, 20819, 21111, 21135, 21136, 21144, 21149, 21150, 21159, 21170, 21172, 21175, 21251, 21264, 21272, 21307, 21310, and 21313.

21192 (AECL-5032, p 34) HALF LIFE OF ^{133}Xe. Merritt, J. S.; Gibson, F. H. (Chalk River Nuclear Labs., Ont.). Jan 1975.

In Physics Division progress report, October 1 to December 31, 1974. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

21193 (CEA-CONF-3006) DEFORMATION EFFECTS IN NEUTRON SCATTERING FROM THE Sm ISOTOPES. McEllistrem, M. T.; Lachkar, J.; Haouat, G.; Lagrange, C.; Patin, Y.; Shamu, R. E.; Sigaud, J.; Cocu, F. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92- Montrouge (France)). 1975. 4p. (CONF-750303-68). Dep. NTIS (US Sales Only) $4.00.

From proceedings on nuclear cross section and technique; Washington, District of Columbia, USA (3 Mar 1975).

Deformation effects in neutron scattering from isotopically enriched Sm_2O_3 samples have been studied at an incident neutron energy of 7 MeV where a maximum of the deformation effects was observed in total cross section measurements on the same isotopes. Differential cross sections for elastic scattering and inelastic scattering (first 2^+ state) were measured for ^{148}Sm and ^{150}Sm and for ^{148}Nd, which was included in this study to aid in separating isospin effects from deformation effects. Cross sections for the sum of elastic and inelastic scattering (first 2^+ state) were determined for ^{152}Sm and ^{154}Sm. Experimental cross sections are compared to the results of non-spherical optical-potential coupled-channel calculations. (4 figures) (auth)

21194 (COO-3239-12) NUCLEAR CHEMISTRY RESEARCH OF HIGH ENERGY NUCLEAR REACTIONS AT CARNEGIE-MELLON UNIVERSITY. Progress Report, 1974-1975. (Carnegie-Mellon Univ., Pittsburgh, Pa. (USA). Dept. of Chemistry). May 1975. 60p. Dep. NTIS $6.00.

Progress in the study of high energy nuclear reactions between June 1, 1974 and May 31, 1975 is reported. Five different major experiments were investigated. The ^{48}Ti(p,2p)^{47}Sc and ^{49}Ti(p,ppi)^{48}Sc cross sections were measured at 11.5 and 300 GeV. Cross sections for single-nucleon knock-out reactions induced with protons of 800 MeV and alpha particles of 700 MeV were measured for ^{90}Zr, ^{92}Zr, ^{96}Mo, ^{98}Ru, and ^{102}Pd. A systematic study of high energy alpha spallation reactions on enriched ^{92}Mo, ^{96}Mo and ^{100}Mo was undertaken to investigate the effect of target composition on the isobaric yield distribution; cross sections for four A equals 72 isobars and 14 other nuclides in the mass range 65 to 76 were determined. The yields and angular distributions for the production of the various boron nuclides from the interaction of 120-MeV ^{12}C ions with ^{65}Cu were determined. A study of heavy-ion-induced (p,n)- and (n,p)-type reactions resulting from the interaction of ^{12}C with ^{63}Cu is reported. (RWR)

For title listings of individual papers see: 21153, 21179, 21195, 21196, and 21197.

21195 (COO-3239-12, pp 4-33) ISOBARIC YIELD CURVES IN THE INTERACTION OF 720 MeV ALPHA PARTICLES WITH ^{92}Mo, ^{96}Mo, ^{100}Mo. Ku, T. H. H. May 1975.

In nuclear chemistry research of high energy nuclear reactions at Carnegie-Mellon University. Progress report, 1974-1975. (Carnegie-Mellon Univ., Pittsburgh, Pa. (USA). Dept. of Chemistry).

21196 (COO-3239-12, pp 41-46) STUDY OF SINGLE NUCLEON KNOCK-OUT REACTIONS AT HIGH ENERGIES. Yates, M. A. May 1975.

In nuclear chemistry research of high energy nuclear reactions at Carnegie-Mellon University. Progress report, 1974-1975. (Carnegie-Mellon Univ., Pittsburgh, Pa. (USA). Dept. of Chemistry).

21197 (COO-3239-12, pp 47-50) NUCLEAR STRUCTURE EFFECTS IN PION INDUCED NUCLEAR REACTIONS. Yester, M. V.; Karol, P. J. May 1975.

In nuclear chemistry research of high energy nuclear reactions at Carnegie-Mellon University. Progress report, 1974-1975. (Carnegie-Mellon Univ., Pittsburgh, Pa. (USA). Dept. of Chemistry).

21198 (IS-T-673) ON-LINE GAMMA--GAMMA ANGULAR CORRELATION STUDIES OF CASCADES IN ^{140}Ba, ^{90}Sr, AND ^{140}Cs. Alquist, L. J. (Ames Lab., Iowa (USA)). May 1975. Contract W-7405-eng-82. 148p. Dep. NTIS $10.50.

Thesis.

Angular correlation measurements were made on gamma-ray cascades in ^{140}Ba, ^{90}Sr, and ^{140}Cs. These fission-product activities were isobarically enhanced from Kr and Xe noble-gas parents, which were mass-separated by the TRISTAN isotope separator system. Levels in ^{140}Ba were populated from the 64-sec decay of ^{140}Cs, and in ^{140}Cs from the 14-sec decay of ^{140}Xe. Levels in ^{90}Sr were populated from the 2.7-min decay of ^{90}Rb, which was populated from the decay of ^{90}Kr. The most intense transitions were measured in coincidence with the first excited state to ground state transition in even-even ^{140}Ba and ^{90}Sr. The two-parameter mode of data accumulation was used to study cascades with transitions in coincidence with the 806-keV and 989-keV transitions in odd-odd ^{140}Cs. In the study of cascades in ^{140}Ba definite spin assignments were made for eight levels, and tentative spin assignments for five levels. For ^{90}Sr definite spin assignments were made for eight levels, and tentative assignments for six levels. A definite 1- spin-parity assignment was made for the 103-keV level in ^{140}Cs, and tentative assignments were made for five other levels. Values are given for the angular correlation coefficients, and limits of multipolarity mixing ratios are given where applicable. (44 figures, 3 tables) (auth)

21199 (NP-20429) RATIO OF THE CROSS SECTIONS FOR THE FORMATION OF ISOMERIC STATES OF ^{134m,f}Cs, ^{135m,f}Cs, AND ^{84m}Rb PRODUCED BY REACTIONS INDUCED ON ^{139}La AND ^{89}Y BY DIFFERENT PROJECTILES: p, d, ^{3}He, AND ^{4}He. Krupa, J. C. (Paris-1 Univ., 75 (France)). 18 Jun 1974. 121p. (In French). Dep. NTIS (US Sales Only) $9.25.

Thesis.

The ratios of the formation cross sections for the isomeric states of ^{134}Cs, ^{135}Cs, and ^{84}Rb produced in ^{139}La and ^{89}Y targets bombarded by protons, deuterons, ^{3}He, and α particles at energies from 40 to 160 MeV were experimentally measured in order to distinguish the dominant formation mechanisms, to analyze the effects of the angular momentum, and to test the predictions of the statistical model when these reactions proceed by formation of a compound nucleus. The dominant mechanism appears to be a quasi-elastic scattering process on a substructure α at the surface of the nucleus, characterized by a constant ratio. Data were obtained on the angular momentum of the α substructure of the peripheral shells. A calculation based on one proposed by Huizenga and Vandenbosch made it possible, within the framework of the statistical model of the compound nucleus, to consider the different mechanisms observed. (JSR)

21200 (NP-20480(PS), pp 12-14) MULTI-NUCLEON TRANSFER REACTIONS ON Mo ISOTOPES BY ^{14}N AT E_L = 97 MeV. Yoshie, M.; Kamitsubo, H.; Katori, K.; Kohno, I.; Motobayashi, T.; Nakajima, S.; Mikumo, T. Dec 1974.

In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

21201 (NP-20480(PS), pp 15-18) SINGLE-NUCLEON TRANSFER REACTIONS ON ^{93}Mo INDUCED BY ^{4}N AND ^{12}C. Yoshie, M.; Katori, K.; Kohno, I.; Mikumo, T.; Motobayashi, T.; Nakajima, S.; Kamitsubo, H. Dec 1974.

In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

21202 (ORNL-5025, pp 32-34) HEAVY-ION-INDUCED FISSION AND FUSION OF MEDIUM-MASS NUCLEI. Plasil, F.; Pleasonton, F.; Ferguson, R. L.; Hahn, R. L. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

Studies of fission and fusion were continued with ^{12}C and ^{20}Ne ions incident on targets ranging from ^{107}Ag to ^{141}Pr. Excitation functions for fission and for evaporation residues have been measured for the systems ^{107}Ag + ^{20}Ne, ^{133}Cs + ^{20}Ne, and ^{141}Pr + ^{12}C. Investigations are also continuing in order to obtain values for the fission barrier at zero angular momentum for light systems. It has been found that the lowering of the fission barrier with increasing angular momentum can be described semiquantitatively with the rotating liquid drop model. (SDF)

21203 (ORNL-5025, pp 40-42) ELASTIC AND INELASTIC SCATTERING OF 70-MeV ^{12}C IONS FROM ^{144}Nd. Hillis, D. L.; GROSS, E. E.; Hensley, D. C.; Halbert, M. L.; Bingham, C. R.; Riedinger, L. L.; Scott, A.; Martin, D. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

Incident ^{12}C ions were scattered from a ^{144}Nd target, and the reaction products were detected. Angular distributions were measured between 20 and 80 degrees in the lab system for 2^+, 4^+, and 3^- states at 696, 1314, and 1511 keV respectively. Calculated deformation parameters are shown and compared with previous values. It is concluded that the observed interference effects for the 2^+ and 3^- states of ^{144}Nd can be well described by the DWBA formalism, but that the two step nature of the 4^+ state requires a coupled channel approach. (1 figure, 1 table) (SDF)

21204 (ORNL-5025, pp 49-51) ABSOLUTE CROSS SECTIONS FOR (^{4}N,4n) AND (^{4}N,5n) REACTIONS INDUCED ON ^{141}Pr AND ^{142}Nd. Schmidt-Ott, W. D.; Toth, K. S.; Zganjar, E. F. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

Using measured alpha branches of ^{150}Dy, ^{151}Dy, ^{151}Ho, and ^{152}Ho, the cross sections for (^{4}N,4n) and (^{4}N,5n) reactions induced on ^{141}Pr and ^{142}Nd targets have been determined. Results are compared with experiment. (2 tables, 1 figure) (SDF)

21205 (ORNL-5025, pp 51-54) EXCITATION ENERGIES OF THE h/sub 11/2/ AND d/sub 3/2/ NEUTRON STATES IN ^{145}Gd AND ^{147}Dy. Toth, K. S.; Rainis, A. E.; Bingham, C. R.; Newman, E.; Carter, H. K.; Schmidt-Ott, W. D. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

A search for ^{147}Dy in the M4 isometric series at N equals 81 was undertaken by bombarding at thin target of ^{141}Pr with ^{14}N. The data have established that the h/sub 11/2/ and d/sub 3/2/ neutron states in ^{147}Dy are 750.7 and 72.0 keV above the S/sub 1/2/ ground states. Results for ^{147}Gd suggest that the h/sub 11/2/ and d/sub 3/2/ states are located at 748.7 and 27.3 keV, respectively. A summary of the excitation energies of the S/sub 1/2, d/sub 3/2/, and h/sub 11/2/ neutron states for N equals 81 nuclei is provided. (2 figures, 1 table) (SDF)

21206 (ORNL-5025, pp 54-56) OBSERVATION OF 1^+(pi h/sub 11/2/, vh/sub 9/2/) STATES IN ^{149,150,152}Tb POPULATED IN THE DECAY OF THEIR DYSPROSIUM PARENTS. Toth, K. S.; Newman, E.; Bingham, C. R.; Rainis, A. E.; Schmidt-Ott, W. D. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

Experiments have been made to investigate details of the decay of ^{148}Dy and to confirm its nuclidic assignment. Gamma ray yields are presented as a function of bombarding energy for ^{12}C ions incident on ^{142}Nd. The proposed decay scheme is presented, and the 0^+ yields 1^+ beta transition is discussed. In addition, the proposed electron capture decay schemes of ^{150}Dy and ^{152}Dy are given. It is concluded that their beta decays proceed entirely through 1^+ states of their respective terbium daughters. (4 figures) (SDF)

21207 (ORNL-5025, pp 101-103) COULOMB EXCITATION OF ^{113,115}In. Tuttle, W. K. III; Stelson, P. H.; McGowan, F. K.; Milner, W. T.; Raman, S.; Robinson, R. L. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

In order to test a model which predicts the structure of nuclei near closed shells to be described by coupling a particle or hole to a vibrating core, Coulomb excitation experiments have been performed on ^{113}In and ^{115}In. A summary of B(E2) values is obtained is provided. (1 figure, 1 table) (SDF)

21208 (ORNL-5025, pp 127-129) NEUTRON CAPTURE GAMMA-RAY STUDIES. Slaughter, G. G.; Raman, S.; Jurney, E. T.; Wells, J. C. Jr.; Carlton, R. F. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

The energy levels in ^{144}Nd have been investigated in detail via the ^{143}Nd(n,gamma) reaction with thermal and resonance neutrons. In thermal measurements, about 500 gamma rays in the 0.1 to 6.5 MeV region have been identified. The resonance measurements were able to distinguish many gamma rays which were questionable in the thermal studies. (n,gamma) reactions with ^{118}Sn, ^{120}Sn, and ^{122}Sn have also been investigated, and the ^{121}Sn level scheme is presented. (2 figures) (SDF)

21209 (ORNL-TM-4896) REVISED LIGHT ELEMENT LIBRARY FOR THE ORIGEN CODE. Kee, C. W. (Oak Ridge National Lab., Tenn. (USA)). May 1975. Contract W-7405-eng-26. 67p. Dep. NTIS $6.50.

To extend the convenient areas of application of ORIGEN, a larger library was prepared for neutron activation studies. The new library includes 674 nuclides and all naturally occurring nuclides with atomic number less than 84. (auth)

21210 (UUIP-884) POSSIBLE ROTATIONAL STATES IN LIGHT ODD-In NUCLEI. Dietrich, W.; Ragnarsson, I.; Baecklin, A.; Lannergard, C. O. (Uppsala Univ. (Sweden). Fysiska Institutionen). Nov 1974. 31p. Dep. NTIS (US Sales Only) $4.75.

Levels and transitions in ^{107}In and ^{109}In have been studied in in-beam spectroscopy on the reactions ^{106}Cd(d,nγ)^{107}In and ^{108}Cd(d,nγ)^{109}In. Low-lying $\frac{1}{2}^+$ and $\frac{3}{2}^+$ states indicating a possible rotational band similar to that observed in the heavier In isotopes are observed in both nuclei. The potential energy has been calculated for $^{107-121}$In with the odd proton in different orbitals, using the Strutinsky normalization procedure. A prolate minimum is obtained for the lowest $\frac{1}{2}^+$ orbital, which is in good agreement with the experimental data for $^{115-119}$In. The excitation energy of the $\frac{1}{2}^+$ minimum shows a fairly good agreement with experimental data. (12 figures, 3 tables) (auth)

21211 MEASUREMENT OF THE ABSOLUTE INTENSITY OF THE 919.2-keV GAMMA RAY OF ^{94}Y. Cavallini, P.; Blachot, J. (Centre d'Etudes Nucleaires de Grenoble, France). Radiochem. Radioanal. Lett.; 21: No. 3-4, 151-156(10 May 1975).

The 919.2 keV γ-ray absolute intensity of ^{94}Y has been deduced by comparing its radioactivity respectively with that of the 1024.2 keV of ^{91}Sr, 266.9 keV and 947.1 keV of ^{93}Y, and 954.2 keV of ^{95}Y γ-rays, after separation from fission products of the Y, Sr fraction. The mean value computed using total yields data of the A = 91, 93, 94, 95 chains and the absolute intensities of the above-mentioned γ-rays is $I_{919.2} = 0.56 \pm 0.03$ per disintegration. (auth)

21212 MEASUREMENT OF THE ABSOLUTE INTENSITY OF THE 954.2-keV GAMMA RAY OF ^{95}Y. Cavallini, P.; Blachot, J. (Centre d'Etudes Nucleaires de Grenoble, France). Radiochem. Radioanal. Lett.; 21: No. 3-4, 157-159(10 May 1975).

The 954.2 keV γ ray absolute intensity of ^{95}Y has been measured through the evolution of the radioactivity of the 954.2 keV of ^{95}Y together with that of the 724.3 keV and 756.7 keV of its β^- decay product ^{95}Zr, after separation of the yttrium from fission products. The obtained mean value is $I_{954.2} = 0.19 \pm 0.02$ per disintegration. (auth)

21213 YIELDS OF ^{111}In AND ^{114m}In IN NUCLEAR REACTIONS WITH PROTONS, DEUTERONS, AND ALPHA PARTICLES. Dmitriev, P. P.; Dmitrieva, Z. P.; Krasnov, N. N.; Molin, G. A.; Panarin, M. V. Sov. At. Energy (Engl. Transl.); 37: No. 6, 1274-1276(Dec 1974).

Translated from At. Energ. (USSR); 37: No. 6, 496-497(Dec 1974).

The dependence of the bombarding particles on energy of the yields of ^{111}In and ^{114m}In during irradiation of metallic cadmium with protons and deuterons, and the yields of ^{111}In during irradiation of metallic silver with alpha particles was measured. The reactions of formation of ^{111}In and ^{114m}In, the energy thresholds, and the yields measured at maximum bombarding particle energy are tabulated. (1 table, 1 figure) (SDF)

21214 STUDY OF GAMMA DECAY OF PARTICLE-TRUNC- STATES IN ^{208}Pb, ^{93}Mo AND ^{88}Sr. Duennweber, W. Heidelberg; Univ. Heidelberg (1971). 64p. (In German). INIS.

Thesis.

From ^{208}Pb(d,pγ)^{209}Pb, ^{92}Mo(d,pγ)^{93}Mo and ^{88}Sr(d,pγ)^{89}Sr coincidence measurements the γ-decay schemes of the three final nuclei were obtained. Great solid angles made it possible to

detect the decay of particle-trunc-states with very small one particle mixing. By the decay scheme several states with very pure particle-vibration configuration are identified in ^{209}Pb. (GE)

21215 RADIOISOTOPE-PRODUCTION RATES FROM MUON CAPTURE. Heusser, G. Heidelberg; Univ. Heidelberg (1971). 50p. (In German). INIS.

Thesis.

The cosmic radiation including its secondary components generates in general small isotope shifts in matter. Especially in rare gases and radioisotopes the effect of cosmic radiation can be studied. For the many possibilities, which are given for naturally induced muonic radioisotopes it is necessary to know the production rate. The aim of this work was to measure such rates by experiments on accelerators. (GE)

21216 NUCLEAR CORE SPECTROSCOPY STUDIES OF NEUTRON DEPLETED ODD ISOTOPES OF ELEMENTS FROM CERIUM TO GADOLINIUM. Klewe-Nebenuis, H. Heidelberg; Univ. Heidelberg (1973). 92p. (In German). INIS.

Thesis.

In the nuclide region which is limited by closed shells with Z = 50 and N = 82 neutron depleted nuclei are produced via (α,xn + yp + zα)-reactions and investigates systematically by γ-spectroscopic measurements. Numerous up to now unknown nuclides and levels could be identified, partly their lifetimes determined and γ-lines tentatively arranged in level schemes. The decays ^{143}Gd → ^{143}Eu, ^{141}Eu → ^{141}Sm, ^{139}Sm → ^{139}Pm → ^{139}Nd, and ^{137}Pm → ^{137}Nd → ^{137}Pr are reported. A detailed level scheme for ^{137}Pr could be established and discussed in the framework of theoretical models. There were hints for deformation of that nucleus. (GE)

21217 LIFETIME MEASUREMENT OF THE FIRST EXCITED $1/2^+$ STATE OF THE ATOMIC NUCLEI ^{123}I, ^{121}I AND ^{119}I. Schrader, H. Brunswick; Technische Univ. (1971). 68p. (In German). INIS.

Thesis.

The use of an on-line mass separator for production of the radioactive sources allowed the lifetimes to be measured of excited states of the low-neutron atomic nuclei ^{123}I, ^{121}I and ^{119}I which are populated by Xe decays with halflives between 2.1 h and 6 min. The mass separator was directly connected to the target of a 600 MeV synchrocyclotron (ISOLDE project of CERN at Geneva). The radioactive sources were sent into the counting room via a pneumatic system after a few minutes of collection on aluminum terminal strips. Since the low-energy decay schemes of the iodine nuclei were known, the lifetime of the first excited $1/2^+$ state of these nuclei could be determined and assigned. The measurements were carried out with NaI(Tl) photomultiplier detectors in a slow-fast coincidence arrangement. Evaluation by the FRANTIC program indicated the following halflives: ^{123}I (148.9 keV): $T_{1/2}$ = (2.44 ± 0.09) nsec; ^{121}I (95.7 keV): $T_{1/2}$ = (8.3 ± 0.4) nsec; ^{119}I (85.8 keV): $T_{1/2}$ = (10.6 ± 0.5) nsec. They connect up with values measured of the $1/2^+$ state of the ^{127}I and ^{125}I nuclei by Kownacki et al. In this way, it is possible to compare the γ-transition probabilities of five analogous states systematically with predictions of nuclear models. (GE)

21218 HAUSER-FESHBACH ANALYSIS OF THE REACTION ^{91}Zr(p,n)^{91}Nb. Jahnke, U. Berlin; Freie Univ. (17 Dec 1970). 58p. (In German). INIS.

Thesis.

The differential cross sections of the ^{91}Zr(p,n)^{91}Nb reaction were measured to all final states up to the excitation energy of 2.8 MeV in a time-of-flight experiment using incident energies between 4.5 and 5.4 MeV. For two incident energies the reaction occurs through T = 6 analog states in the compound nucleus. The measurements are analyzed on the basis of the statistical model of the compound nucleus reaction. The cross sections and angular distributions are calculated according to Hauser–Feshbach formulae and simplified formulae in which the sum over the open reaction channels is expressed in terms of the width and the distance of the compound states and the spin distribution in the residual nucleus. The transmission coefficients for neutrons are determined experimentally from the branching ratio in the decay of the 4^+ and 2^+ analog states to ^{91}Nb states whose spin and parity are known; the transmission of the protons is calculated on the basis of several parameter laws of the optical model from the literature. (GE)

21219 POLARIZATION STUDIES OF ISOBARIC ANALOG RESONANCES FROM ELASTIC PROTON SCATTERING WITH ^{126}Te, ^{128}Te AND ^{130}Te. Roth, M. Cologne; Cologne Univ. (1972). 57p. (In German). INIS.

Thesis.

The study relates to polarization experiments on isobaric analog resonances in ^{127}I, ^{129}I and ^{131}I. They correspond to the low negative-parity states in ^{127}Te, ^{129}Te and ^{131}Te. The excitation functions of the polarization and of the differential cross section of the elastic scattering of protons were measured on the target isotopes of ^{126}Te, ^{128}Te and ^{130}Te. The measurement serves the purpose of allowing a reliable assessment to be made of the spins of the analog states and their parent states. For accurate resonance analysis the analog resonances in ^{131}I were investigated also by the elastic scattering of polarized protons. The excitation functions of the analyzing power were recorded at angles of 90°, 110°, 130° and 150°. The analysis of the cross section and polarization and analyzing power is carried out in the S-matrix formalism. The scattering matrix in this case contains Breit–Wigner terms and a non-resonant fraction described by the optical model. From the polarization measurements the spin values of $7/2^-$, $7/2^-$, $7/2^-$, $3/2^-$, $5/2^-$, $3/2^-$, $1/2^-$ were found for analog resonances in ^{127}I, $7/2^-$, $7/2^-$, $3/2^-$, $3/2^-$ for those in ^{129}I, and $7/2^-$, $3/2^-$, $3/2^-$ for those in ^{131}I. This is the first experimental determination of these spins. Analysis of the analyzing power furnishes accurate values of the resonance energy, the total width, the partial width and the resonance mixing phase for analog resonances in ^{131}I. (GE)

21220 INVESTIGATIONS ON THE INTERNAL CONVERSION IN $^{103}_{45}$Rh, $^{115}_{49}$In, $^{134}_{55}$Cs, $^{135}_{56}$Ba AND $^{153}_{63}$Eu. Merkert, D. 1973. 24p. (In German). INIS.

Thesis.

Relative conversion electron intensities for L to O and P atomic shells were measured for the first time for γ transitions of the multipolarity L ≥ 3 in ^{103}Rh, ^{115}In, ^{134}Cs and ^{135}Ba at the Heidelberg β spectrometer. Theoretical conversion coefficients were calculated for the γ transitions on the basis of various physical models. Exact calculations were made for the atomic shells K to N7 within three models (non-relativistic Thomas–Fermi–Dirac, Hartree–Fock–Slater and relativistic Hartree–Fock–Slater atomic models). The best agreement was obtained for the relativistic Hartree–Fock–Slater model. Relative conversion electron intensities of the γ-hindered 70-keV M1 and 103-keV M1 transitions were measured in ^{153}Eu. The experimental values are describable in a relativistic Hartree–Fock–Slater Model, which involves, besides statistical influences of the nucleus on the electron configuration, also dynamic correction coefficients. (GE)

21221 ENERGY DISTRIBUTIONS OF LIGHT IONS FROM PHOTOREACTIONS WITH BREMSSTRAHLUNG OF 450 MeV E_γ^{max}. Stein, G. Bonn; Univ. Bonn (1973). 39p. (In German). INIS.

Thesis.

In agreement with particle-induced reactions at intermediate energies of about 50 MeV, the γ-energy distribution generated by a bremsstrahlung spectrum of 0.45-GeV E_γ^{max} on heavy target nuclei Ag, Ta and Au cannot be explained by the compound nucleus model. The results for the (γ,α) reactions on light and intermediate nuclei up to Nb, however, are well explained by this model, although these nuclei are excited up to 65 MeV. The similarity between the spectra of ^{3}He and tritons can be reduced to similar Q-values. The p spectra cannot be explained with the compound nucleus model over the whole investigated mass region except for Al. The particle yields can be interpreted by superposition of three effects: the strength of the γ absorption cross section in the region of giant resonance, the height of the Coulomb wall and the binding energy of the emitted particle. (GE)

21222 IONIZATION CHAMBER HALF-LIFE MEASUREMENT OF THE 99-MINUTE ^{113m}In ISOMER. Garfinkel, S. B.; Schima, F. J. (National Bureau of Standards, Washington, DC). Int. J. Appl. Radiat. Isot.; 26: No. 5, 314-316(May 1975).

A precise determination of the ^{113m}In half-life has been made by means of a nominal $4\pi\gamma$ pressure ionization chamber. The value obtained was 99.21 min with an uncertainty of 0.13 min which is the linear sum of the component of random error at the 99% confidence level and the estimated systematic errors. (auth)

21223 NONSTATISTICAL BEHAVIORS OF THE LEVEL SPACING DISTRIBUTIONS IN NEUTRON RESONANCES. Ideno, K. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). J. Phys. Soc. Jap.; 37: No. 3, 581-590 (Sep 1974).

Correlations of the level spacings in neutron resonances are analyzed with the method proposed by Ideno and Ohkubo. Periodic structures in the level spacing distributions are found in many nuclei. It is also found that there are coincidences among these periodicities and that there are a number of cases in which multiple relations are observed among them. The origin of the periodicities is discussed. (auth)

21224 ELASTIC AND INELASTIC SCATTERING OF 34.4-MeV ALPHA PARTICLES BY ^{90}Zr, ^{91}Zr, AND ^{92}Zr. Kumabe, I.; Matoba, M. (Kyushu Univ., Fukuoka (Japan). Faculty of Engineering); Ogata, H.; Inoue, M.; Okuma, Y. Bull. Inst. Chem. Res., Kyoto Univ.; 52: No. 1, 152-164(Jul 1974).

The angular distributions of alpha particles elastically and inelastically scattered by ^{90}Zr, ^{91}Zr, and ^{92}Zr have been measured at 34.4 MeV. Scattered alpha particles were detected with a broad-range magnetic analyser and/or a semiconductor detector. The overall energy resolution of about 70 KeV in this experiment enabled resolution of many states. The angular distributions were fitted with the predictions of the collective model using DWBA analysis. The extracted deformation parameter β_1 and deformation length $\beta_1 R_0$ were compared with those obtained by other workers. (auth)

21225 THE ISOMERIC CROSS SECTIONS OF THE (d,p) REACTION ON ^{130}Te. Okamura, H. (Osaka Univ., Toyonaka (Japan). Faculty of Science). Bull. Inst. Chem. Res., Kyoto Univ.; 52: No. 1, 170-176(Jul 1974).

Both isomeric cross sections of ^{130}Te(d,p) ^{131m}Te and ^{131g}Te were measured with the activation method, up to 14.1 MeV deuteron energy. The curves were explained by a new calculation method. (auth)

21226 A REVIEW OF NEUTRON CROSS SECTION RESEARCH. Block, R. C. (Rensselaer Polytechnic Inst., Troy, N. Y. (USA)). Annu. Rep. Res. Reactor Inst., Kyoto Univ.; 7: 41-61(Oct 1974). 49 refs.

Neutron cross section research is reviewed by focusing on the energy region of eV-MeV. The review is divided into two parts; the first part concerns the neutron sources and the second covers experiments for the neutron cross section measurements. Various types of the neutron sources available at present are compared with respect to the energy resolutions, neutron fluxes, and energy ranges. Measurements of the total cross sections and various partial cross sections are reviewed; discrepancies in the data among laboratories are pointed out and the need to reach the best cross section is stressed by addressing intercomparison of the data to scientists. (JA)

Nuclear Properties and Reactions, 150 ≤ A ≤ 189

Refer also to abstracts 19812, 20819, 21111, 21136, 21144, 21159, 21170, 21172, 21175, 21193, 21206, 21209, 21220, 21221, 21223 21252, 21310, and 21328.

21227 (AECL-5032, p 35) HALF LIFE OF ^{169}Yb. Merritt, J. S.; Gibson, F. H. (Chalk River Nuclear Labs., Ont.). Jan 1975.

In Physics Division progress report, October 1 to December 31, 1974. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

21228 (COO-2176-34) LEVEL DENSITY CALCULATION FOR DEFORMED NUCLEI. Felvinci, J. P.; Cacuci, D.; Melkonian, E. (Columbia Univ., New York (USA)). 1975. 3p. (CONF-750303-73). Dep. NTIS $4.00.

From proceedings on nuclear cross section and technique; Washington, District of Columbia, USA (3 Mar 1975).

Level densities for the rare earth and actinide nuclei have been calculated using a modified version of the Ericson formalism. The assumption was made, that K (the projection of J on the symmetry axis of the nucleus) is a good quantum number in the compound nucleus. Individual level densities for the different (K,J) values of the compound nucleus formed by low energy neutron interactions were calculated. The results show good agreement with the interpretation of recent results obtained on U-235 in this laboratory. Using the above calculations it is also possible to infer from the measured level densities the locations of the band heads of different K bands in the compound nucleus. The results also indicate that the K bands responsible for the level densities exclude the ground state rotational band. Levels built on the higher lying beta and gamma vibrational bands and their composites are sufficient in number to explain the observed level densities. (4 tables) (auth)

21229 (JINR-P6-8823) CORRELATIONS OF DIRECTIONS OF γ-RADIATION IN ^{153}Gd. Alikov, B. A.; Budzynski, M.; Bedike, T. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Gamma directional correlations in the decay ^{153}Tb → ^{153}Gd were studied for the cascades 82.9-87.6 keV, 82.9-(19)-109.7 keV, 82.9-129.1 keV, 102.2-68.2 keV, 139.7-109.7 keV, 174.3-87.6 keV, 174.3-(19)-109.7 keV, 102.2-109.7 keV, 186.9-129.1 keV, 193.7-109.7 keV, 206.3-109.7 keV, 332.5-109.7 keV, 835.4-109.7 keV, 845.6-109.7 keV, and 991.7-109.7 keV. Spin values were determined for the energy levels as follows: 41.5 keV, 5/2; 109.7, 1/2; 129.1, 3/2; 211.9, 3/2; 249.5, 5/2; 303.5, 5/2; 316.1, 3/2; 442.2, 1/2; 945.1, 3/2; 955.3, 5/2; and 1101.5, 3/2. The coefficients are given for δ_γ transition mixture 68.2, 87.6, 109.7 and 129.1 keV. The spin values of other ^{153}Gd levels are discussed. (3 figures, 4 tables) (auth)

21230 (NP-20480(P8), pp 61-63) CCBA ANALYSIS OF (p,t) REACTIONS ON RARE-EARTH NUCLEI. Wakai, M.; Sano, M.; Takemasa, T.; Yamaji, S. Dec 1974.

In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

21231 (ORNL-5025, pp 28-31) DOMINANCE OF THE I/sub 13/2/ NEUTRON IN YTTERBIUM BACKBENDING. Riedinger, L. L.; Smith, G. J.; Stelson, P. H.; Eichler, E.; Hensley, D. C.; Johnson, N. R.; Robinson, R. L.; Sayer, R. O. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

Experiments have been performed in order to work out the details of the ^{165}Yb level scheme, populated in the ^{156}Gd(^{12}C,3n) and ^{148}Nd(^{22}Ne,5n) reactions. The central role of the i/sub 13/2/ neutron orbitals to the backbending phenomena in ^{165}Yb was established. (3 figures, 1 table) (SDF)

21232 (ORNL-5025, pp 31-32) ROTATIONAL BANDS IN EVEN-A NUCLEI. Riedinger, L. L.; Smith, G. J.; Stelson, P. H.; Eichler, E.; Hensley, D. C.; Hubert, P.; Johnson, N. R.; Robinson, R. L.; Sayer, R. O. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

Angular distribution experiments on gamma rays of ^{170}W and ^{176}Os produced in the reactions (^{20}Ne,6n) have been performed in order to augment earlier research in backbending in these nuclei. Results are shown for the reaction ^{162}(^{20}Ne,6n)^{176}Os. (1 table) (SDF)

21233 (ORNL-5025, pp 32) LIFETIMES OF ROTATIONAL STATES IN ^{164}Dy BY THE DOPPLER-SHIFT RECOIL DISTANCE METHOD. Sayer, R. O.; Sturm, R. J.; Johnson, N. R.; Eichler, E.; Singhal, N. C.; Guidry, M. W.; O'Kelley, G. D. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

21234 (ORNL-5025, pp 34-36) REACTIONS OF ^{40}Ar WITH ^{160}Dy AND ^{174}Yb. Hahn, R. L.; Toth, K. S.; LeBeyec, Y.; Eppley, R. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

The excitation functions for the reactions of ^{40}Ar with ^{160}Dy and ^{144}Yb leading to the compound nucleus ^{200}Po have been determined. The study is part of a project to compare the reactions ^{160}Dy + ^{40}Ar and ^{116}Cd + ^{84}Kr leading to ^{200}Po, with the reactions ^{174}Yb + ^{40}Ar and ^{130}Te + ^{84}Kr leading to the compound nucleus ^{214}Ra. (3 figures) (SDF)

21235 (ORNL-5025, pp 56-60) ALPHA-DECAY BRANCHING RATIOS FOR ^{151}Tb, ^{150,151,152,153}Dy, and ^{152,153,154,155}Er. Toth, K. S.; Bingham, C. R.; Schmidt-Ott, W. D. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

Isotopes of erbium, dysprosium, and terbium were produced by ^{12}C bombardment of ^{147}Sm and ^{144}Nd. Their alpha branching ratios were deduced from kalpha x-ray intensities and decay schemes. The decay data was then considered within a theoretical framework to obtain alpha decay reduced widths. (2 figures, 3 tables) (SDF)

21236 (ORNL-5025, pp 99-101) ELECTRIC QUADRUPOLE MOMENT OF THE 2^+ STATE IN ^{166}Er. McGowan, F. K.; Milner, W. T.; Sayer, R. O.; Robinson, R. L.; Stelson, P. H. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

The Coulomb excitation reaction has been used to investigate the static electric quadrupole moment of the 2^+ state in ^{166}Er. Experimental excitation probabilities are compared with calculated probabilities from a semi-classical coupled channels code. (1 figure) (SDF)

21237 (ORNL-5025, pp 103-106) INVESTIGATION OF ^{13}C + ^{144}Sm NEUTRON TRANSFER REACTIONS NEAR 70 MeV. Ford, J. L. C. Jr.; Thornton, S. T.; Friedland, E.; Wiedner, C. A.; Goldschmidt, M. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

Data for the ^{144}Sm(^{13}C,^{12}C)^{145}Sm and ^{144}Sm(^{13}C,^{14}C)^{143}Sm reactions were taken at incident energies of 66 and 72 MeV respectively. In addition, elastic scattering of ^{13}C from ^{144}Sm at 66 MeV was performed to obtain optical model parameters for cross

section calculations. Experimental cross sections along with DWBA predictions for ^{144}Sm(^{13}C,^{14}C) and spectroscopic factors for ^{143}Sm are given. Results for the ^{144}Sm(^{13}C,^{12}C) reaction are not as clear. (2 figures, 1 table) (SDF)

21238 (ORNL-5025, pp 122-125) LEVEL SPACING AND S-WAVE NEUTRON STRENGTH FUNCTION OF ^{180}Ta + n. Harvey, J. A.; Hill, N. W.; Mapoles, E. R. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

Neutron transmission measurements were made on a sample of ^{181}Ta enriched to 5.47 percent in ^{180}Ta and a matching sample of natural tantalum (0.01 percent ^{180}Ta) in order to correct for ^{181}Ta resonances. ^{180}Ta resonance parameters obtained from shape analysis are tabulated. (3 figures, 1 table) (SDF)

21239 MULTIPOLE MIXING RATIOS OF TRANSITIONS IN ^{156}Gd. Uluer, I. (Sussex Univ., Brighton, Eng.); Kalfas, C. A.; Hamilton, W. D.; Fox, R. A.; Warner, D. D.; Finger, M.; Chung, D. K. J. Phys., G (London); 1: No. 4, 476-486(5 May 1975).

Using γ-$\gamma(\theta)$, and e_K-$\gamma(\theta)$ directional correlation and $\gamma(\theta)$ (nuclear orientation) techniques the multipole character of twenty-one transitions occurring in ^{156}Gd following the decay of ^{156}Tb have been determined. For the γ-γ directional correlation measurements a good energy resolution system employing a Ge(Li) and a NaI(Tl) detector was used while for the e_K-γ correlations a NaI(Tl) detector and a magnetic lens spectrometer were used. The nuclear orientation measurements were carried out at low temperatures obtained with a ^{3}He-^{4}He dilution refrigerator to which an adiabatic stage was attached. The observed mixing ratios show that the transitions de-exciting the γ band and the 5^+ and 4^+ rotational levels are predominantly E2, and that the γ rays originating from the 3^- and 4^- rotational levels are predominantly E1. The 4^+(rot)-6^+(gr), 4^+(rot)-2^+(gr), 4^+(rot)-$2^+(\gamma)$ transitions de-exciting the 1510.7 keV (K = 4) level are shown to have M3 admixtures. The signs and magnitudes of the multipole mixing ratios of the 2(γ)-2(gr), 3(γ)-2(gr), 3(γ)-4(gr), and 4(γ)-4(gr) transitions are consistent with the tabulated values of the other even-even nuclei in this region. (auth)

21240 DIFFERENTIAL ANGULAR CORRELATION OF THE 70-103 KeV CASCADE IN ^{153}Eu IN DIFFERENT LIQUID SOURCES. Sinha, B. K.; Bhattacharya, R. (Saha Inst. of Nuclear Physics, Calcutta). J. Phys., G (London); 1: No. 4, 467-475(5 May 1975).

Perturbation studies on the 70 to 103 keV cascade of ^{153}Eu have been performed in both Eu-nitrate and Eu-perchlorate solutions using a time-differential technique. The value of the relaxation constant λ_2 was found to be $(1.41 \pm 0.63) \times 10^8$ s^{-1} for the nitrate source and $(0.88 \pm 0.38) \times 10^8$ s^{-1} for the perchlorate source. The unperturbed value of the A_2 coefficient for the 70 to 103 keV angular correlation is found to be $A_2(O) = +0.053 \pm 0.011$ for the nitrate source and $A_2(O) = +0.048 \pm 0.007$ for the perchlorate source indicating an average value of $A_2(O) = +0.049 \pm 0.006$. The magnetic moment of the 103 keV $\frac{3}{2}^+$ state has been measured to be $\mu = 2.07 \pm 0.50$ nm. (auth)

21241 NEUTRON RESONANCES IN OSMIUM ISOTOPES IN THE 4 TO 300 eV RANGE. Belanova, T. S.; Kolesov, A. G.; Safonov, V. A.; Kalebin, S. M. Sov. At. Energy (Engl. Transl.); 37: No. 5, 1204-1205(Nov 1974).

Translated from At. Energ. (USSR); 37: No. 5, 437(Nov. 1974).

The transmissions of highly enriched samples of ^{186}Os, ^{187}Os, ^{188}Os, ^{189}Os, ^{190}Os, and ^{192}Os were measured by the time-of-flight method. Neutrons were detected by He counters with a resolution of 70 ns/m. 25 new levels for all the Os isotopes were observed, and the energies of these resonances are tabulated. (2 tables) (RWR)

21242 DECAY OF ^{154}Pm TO LEVELS OF ^{154}Sm. Yamamoto, H.; Kawade, K.; Fukaya, H.; Katoh, T. Nagoya Univ. (Japan). Faculty of Engineering). J. Phys. Soc. Jap.; 37: No. 1, 10-16 (Jul 1974).

Decay of ^{154}Pm isomers has been studied with Ge(Li), NaI(Tl) and plastic detectors. Sources were prepared by the ^{154}Sm(n,p) ^{154}Pm reaction with about 15 MeV neutrons. Seventy-five γ-rays have been observed and 57 of them are assigned to the ^{154}Sm level scheme including four new levels at 1815.8, 1879.3, 2592.3 and 2618.8 keV. Observed Q_β values were 3.9 ± 0.2 MeV. Most probable spin assignments of 0^+ or 1^+ and 3^+ of 4^+ are proposed for the 1.7 ± 0.2 min and 2.9 ± 0.2 min ^{154}Pm, respectively. (auth)

21243 THE ^{158}Gd(p,t)^{156}Gd REACTION. Ishizaki, Y.; Kokame, J. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study); Suehiro, T.; Saji, Y.; Ogata, H. Bull. Inst. Chem. Res., Kyoto Univ.; 52: No. 1, 165-169(Jul 1974).

The ^{158}Gd(p,t)^{156}Gd reaction has been measured at 51.9 MeV of incident energy. The excited states of 1.83 MeV 2^+, 2.01 MeV (0^++2^+), 2.22 MeV 2^+, 2.37 MeV 2^+, 2.60 MeV (4^+), and 3.29 MeV (6^+) have been newly observed. The possibility of the new rotational band of k = 0 is discussed. One of the quadrupole pairing vibrational states is pointed out. (auth)

21244 LEVELS IN ^{173}Lu FROM THE ^{174}Yb(p,2nγ) REACTION. Grassi-Strini, A. M.; Lo Bianco, G.; Moroni, A.; Strini, G.; Tagliaferri, G. (Univ., Milan). Lett. Nuovo Cim.; 13: No. 8, 283-292(21 Jun 1975).

In an attempt to extend the knowledge of the low lying levels of the odd-mass deformed nuclide lutetium-173, the gamma spectra accompanying the reaction ^{174}Yb(p,2n)^{173}Lu was studied. Various levels of lutetium-173 including rotational bands are discussed. (JFP)

Nuclear Properties and Reactions, 190 ≤ A ≤ 219

Refer also to abstracts 19690, 21096, 21097, 21111, 21135, 21136, 21170, 21209, 21214, 21221, 21223, 21228, 21241, 21272, and 21317.

21245 (AECL-5032, pp 20-23) PAULI EXCLUSION PRINCIPLE AND MAGNETIC MOMENTS IN ^{213}Fr. Haeusser, O.; McDonald, A. B.; Alexander, T. K.; Earle, E. D.; Khanna, F. C.; Beer, G. A.; Olin, A. (Univ. of Victoria, British Columbia). Jan 1975.

In Physics Division progress report, October 1 to December 31, 1974. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

21246 (AECL-5032, pp 23-24) NEW ISOMERS IN ^{211}Fr TO ^{214}Fr. Haeusser, O.; McDonald, A. B.; Alexander, T. K.; Earle, E. D.; Beer, G. A.; Olin, A. (Univ. of Victoria, British Columbia). Jan 1975.

In Physics Division progress report, October 1 to December 31, 1974. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.).

21247 (HEDL-TME-72-90, pp HEDL.18-HEDL.21) SHAPE AND SIZE CORRECTIONS FOR SMALL SAMPLE REACTION RATES. Kidman, R. B.; McElroy, W. N.; Kellogg, L. S. Jun 1972.

In LMFBR reaction rate and dosimetry 4th quarterly progress report, March, April, May 1972. (Hanford Engineering Development Lab., Richland, Wash. (USA)).

21248 (NP-20480(P8), pp 30-31) LONG-RANGE α-PARTICLE DECAYS AND LEVEL STRUCTURE OF ^{216}Ra. Nomura, T.; Hiruta, K.; Yoshie, M.; Ikezoe, H.; Fukuda, T.; Hashimoto, O. Dec 1974.

In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

21249 (NP-20480(P8), pp 32-33) ANGULAR DISTRIBUTIONS OF LONG-RANGE α-PARTICLES EMITTED FROM HIGH SPIN STATES IN ^{216}Ra AND STATISTICAL TENSORS. Fukuda, T.; Nomura, T.; Kutschera, W.; Hiruta, K. Dec 1974.

In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

21250 (NP-20480(P8), pp 79-81) SHORT-LIFE RADIOISOTOPES AND ISOMERS OBSERVED VIA Ir + C REACTIONS. Hashizume, A.; Tendow, Y.; Katou, T.; Kumagai, H. Dec 1974.

In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

21251 (ORNL-5025, pp 42-44) TRANSFER REACTIONS AND COULOMB-NUCLEAR INTERFERENCE INDUCED BY ^{12}C IONS ON ^{90}Zr AND ^{208}Pb. Toth, K. S.; Ford, J.L.C. Jr.; Gross, E. E.; Hensley, D. C.; Gustafson, D. E.; Thornton, S. T. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

Reaction mechanism studies on magic shell nuclei have been continued using heavy ion reactions. Angular distributions for the single nucleon transfer reactions (^{12}C,^{13}C) and (^{12}C,^{11}B) on ^{208}Pb at an incident energy of 98 MeV are shown along with the spectrum at 45 degrees. Inelastic scattering to the 3^-, 5^-, and 2^+ states at 2.61, 3.20, and 4.10 MeV in ^{208}Pb was also measured. In addition, ^{12}C elastic and inelastic scattering on ^{90}Zr were studied. Effects of the interference between Coulomb and nuclear excitation were observed. (3 figures) (SDF)

21252 (ORNL-5025, pp 68-79) UNISOR PROJECT. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

The decay of the members of the A equals 188 mass chain beginning with ^{188}Tl has been studied by obtaining gamma and conversion electron multiscaled singles spectra, and gamma-gamma and conversion electron-gamma coincidence data. Data confirm a shift in the Yrast cascade in both ^{184}Hg and ^{186}Hg and provide evidence for band crossing in ^{188}Hg. Under investigation are the A equals 189 chain beginning with thallium and the A equals 191 chain beginning with lead. General features of these decay chains are discussed. The excited states of ^{189}Au and ^{191}Au have also been studied through decay of the corresponding mercury parent. Positron decay Q values have been measured for some neutron deficient Tl, Hg, Xe, and I isotopes. Results are tentative. In addition, study of deformation effects in the mass 190 region has been extended to thallium by lead decays and a value has been obtained for the half life of the ^{189}Pb high spin isomer. (8 figures, 1 table) (SDF)

21253 (ORNL-5025, pp 108-110) GOLD NEUTRON CAPTURE CROSS SECTION FROM 3 to 550 keV. Macklin, R. L.; Halperin, J.; Winters, R. R. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

A precise measurement of the gold thermal neutron capture cross section from 3 to 500 keV has been achieved with unprecedented resolution. (3 figures) (SDF)

21254 (ORNL-5025, pp 126-127) VALUE OF HIGH-RESOLUTION NEUTRON TOTAL CROSS SECTIONS OF ^{206}Pb. Harvey, J. A.; Hill, N. W. May 1975.

In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

The total neutron cross section of ^{206}Pb has been obtained. The information that can be gained from it is briefly discussed. (1 figure) (SDF)

21255 (ORNL-TM-4973) Au(n,xgamma) REACTION CROSS SECTION FOR INCIDENT NEUTRON ENERGIES BETWEEN 0.2 AND 20.0 MeV. Morgan, G. L.; Newman, E. (Oak Ridge National Lab., Tenn. (USA)). Aug 1975. Contract W-7405-eng-26. 56p. Dep. NTIS $6.00.

Differential cross sections for the neutron-induced gamma-ray production from natural gold were measured for incident neutron energies between 0.2 and 20.0 MeV. The Oak Ridge Linear Accelerator (ORELA) was used to provide the neutrons, and a NaI spectrometer, to detect the gamma rays at 125°. The data presented are the double differential cross section, d^{2}sigma/dOMEGAdE, for gamma-ray energies between 0.3 and 10.6 MeV for coarse intervals in incident neutron energy. The integrated yield of gamma rays of energies greater than 300 keV and higher resolution in the neutron energy is also presented. The experimental results are compared with the Evaluated Neutron Data Library (ENDL). (24 figures, 21 tables) (auth)

21256 A DEVICE FOR THE OPTICAL PUMPING OF ALKALI-ISOTOPES FROM NUCLEAR FISSION REACTIONS. Measurement of Spin, Magnetic Nuclear Dipole Moment and Isotopic Shift of ^{205}Hg by Optical Pumping. Giles, J. M. R. Heidelberg; Univ. Heidelberg (1973). 121p. (In German). INIS.

Thesis.

A device for the optical pumping of alkali-isotopes from nuclear fission reactions of ^{235}U is described. Spin, magnetic nuclear dipole moment, hyperfine-structure and isotopic shift of ^{205}Hg are measured. (WL)

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Refer also to abstracts 19372, 19690, 19781, 20501, 20727, 21111, 21127, 21135, 21136, 21223, 21228, 21310, and 21320.

21257 (AERE-R-7785) CHAIN AND INDEPENDENT FISSION PRODUCT YIELDS ADJUSTED TO CONFORM WITH PHYSICAL CONSERVATION LAWS. Crouch, E. A. C. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Feb 1975. 99p. (INDC(UK)-24(G); NEANDC(UK)-161). Dep. NTIS (US Sales Only) $8.00. UK £ 2.00

Previously reported chain yields for the thermal neutron induced fission of ^{233}U, ^{235}U, ^{239}Pu and ^{241}Pu, the fast neutron induced fission of ^{232}Th, ^{233}U, ^{235}U, ^{238}U, ^{239}Pu, ^{240}Pu and ^{241}Pu, and the 14 MeV neutron induced fission of ^{233}U, ^{235}U and ^{238}U have been adjusted to conform with physical conservation laws and the results listed. (20 tables) (auth)

21258 (ANL-8153, pp 18-32) NUCLEAR STRUCTURE AND PROPERTIES AND NUCLEAR-ATOMIC INTERACTIONS. Jan 1975.

In Chemistry Division annual report, July 1973-June 1974. (Argonne National Lab., Ill. (USA)).

The status of theoretical and experimental studies of the nature of residual nuclear interactions and their effect on nuclear excited states in actinide elements is reported. Information obtained concerning nuclear-atomic interactions is discussed. In addition, investigations of alpha and electron capture decay, core emission in beta decay, and beta spectrum shapes are described for several heavy elements. A new measurement of the half-life of ^{233}U is included. (SDF)

21259 (ANL-8153, pp 33-56) NUCLEAR FISSION AND REACTIONS. Jan 1975.

In Chemistry Division annual report, July 1973-June 1974. (Argonne National Lab., Ill. (USA)).

The nuclear fission research programs are designed to elucidate basic features of the fission process. Specifically, (1) factors determining how nucleons of a fissioning nucleus are distributed between two fission fragments, (2) factors determining kinetic energy and excitation energies of fragments, and (3) factors controlling fission lifetimes. To these ends, fission studies are reported for several heavy elements and include investigations of spontaneous and neutron-induced fission, heavy ion reactions, and high energy proton reactions. The status of theoretical research is also discussed. (SDF)

21260 (CEA-CONF-3057) TOTAL CROSS SECTION AND THE FISSION CROSS SECTION OF ^{241}Am IN THE RESONANCE REGION: RESONANCE PARAMETERS. Derrien, H.; Lucas, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91- Gif-sur-Yvette (France). Dept. de Physique Nucleaire). 1975. 5p. (CONF-750303-69). Dep. NTIS (US Sales Only) $4.00.

From proceedings on nuclear cross section and technique; Washington, District of Columbia, USA (3 Mar 1975).

The ^{241}Am total and fission cross sections have been measured in the resonance region, using the 60 MeV Saclay linac as a pulsed neutron source. The resonance parameters obtained by a single level shape analysis of the transmission data are given for 189 levels up to 150 eV neutron energy. The mean level spacing, corrected for 18% of missed resonances in the 0 to 50 eV energy range, is (0.55 ± 0.05) eV. The s-wave neutron strength function value, in the 0 to 150 eV energy range, is equal to (0.94 ± 0.09) 10^{-4}. The average radiation width obtained from 43 resonances is (43.77 ± 0.72) MeV. Only preliminary results of the fission experiment are available now; 38 fission widths are given up to 32 eV neutron energy, with the average value $\langle\Gamma_f\rangle \simeq 0.23$ MeV; the statistical distribution of these fission widths corresponds to an X^2 law with 4 degrees of freedom. An area analysis of the Los Alamos fission data has also been done, from which we obtain 36 Γ_f values in the 20 eV to 50 eV energy range; the corresponding average value is: $\langle\Gamma_f\rangle \simeq 0.52$ meV; the statistical distribution obeys to an X^2 law with 15 degrees of freedom, in disagreement with the Saclay results. (4 figures, 6 tables) (auth)

21261 (CEA-N-1784, p 2) MEASUREMENT OF SOME CUMULATIVE FRACTION IN THE ^{238}U FISSION INDUCED BY 14-MeV NEUTRONS. Feu Alvim Da Silva, C.; Crancon, J. 1974. (In French).

In 2nd semi-annual progress report 1974. Semi-annual bulletin No. 6. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale).

The measurements effected are derived from the so-called Wolsberg method using the high emanation power of barium stearate for rare gases. A table of the results obtained is presented for ^{139}Ba, ^{140}Ba, ^{140}La, ^{141}Ce, ^{142}La, ^{92}Sr, ^{93}Y, ^{95}Zr. (FR)

21262 (COO-2176-35) QUANTUM NUMBERS OF LOW LYING NEUTRON RESONANCES IN U-235. Felvinci, J. P.; Melkonian, E.; Havens, W. W. Jr. (Columbia Univ., New York (USA)). 1975. 4p. (CONF-750303-72). Dep. NTIS $4.00.

From proceedings on nuclear cross section and technique; Washington, District of Columbia, USA (3 Mar 1975).

Experiments were performed at ORELA to measure the low energy fission cross section of ^{235}U. Times of flight of the neutrons causing fission and the fission fragment energy detected by a solid state detector were recorded event-by-event. Analysis of the data showed marked pulse height variation among resonances. Several of the large resonances were shown to be composites and the level density obtained is much higher than previously determined. The results were interpreted by the hypothesis that K is a good quantum number in the compound nucleus. This assumption and the systematic variation of the fission fragment energies among resonances enabled us to assign J and K quantum numbers to many levels. Three families of fission resonances were seen, J equals 4$^-$; K equals 2, J equals 4$^-$; K equals 1, and J equals 3$^-$; K equals 1. Our results have implications as to the accuracy of fission cross section measurements and to the calculation of cross sections in the unresolved energy region. (1 table, 2 figures) (auth)

21263 (COO-2176-36) EVIDENCE FOR STRUCTURE IN THE SEQUENCE OF S-WAVE LEVELS IN ^{238}U. Melkonian, E.; Felvinci, J. P.; Havens, W. W. Jr. (Columbia Univ., New York (USA)). 1975. 2p. (CONF-750303-71). Dep. NTIS $4.00.

From proceedings on nuclear cross section and technique; Washington, District of Columbia, USA (3 Mar 1975).

The levels in ^{238}U show unusual clusterings of large and small levels as evidenced by runs statistics and sequential correlation of values of GAMMA n^0. Also, GAMMA n^0 is found to show significant correlation with GAMMA/sub gamma/. These effects are interpreted in terms of a model which assumes that excitation states are built upon persistent states of collective vibration and that an entering neutron seeks to form those states involving minimum change of particle motion. (2 figures) (auth)

21264 (COO-2479-5) PRECISION NEUTRON CROSS SECTION MEASUREMENTS IN SUPPORT OF THE LMFBR PROGRAM. Annual Progress Report, 1 July 1974–30 June 1975. Block, R. D.; Hockenbury, R. W. (Rensselaer Polytechnic Inst., Troy, N. Y. (USA)). Apr 1975. Contract AT(11-1)-2479. 7p. Dep. NTIS $4.00.

Brief summaries are presented for the following: precision neutron cross section measurements in support of the LMFBR program; sodium total cross sections in the minima; iron filtered beam measurements; a personnel summary. A list of reports issued during the period is appended. (SDF)

21265 (HEDL-TME-72-90) LMFBR REACTION RATE AND DOSIMETRY 4th QUARTERLY PROGRESS REPORT, MARCH, APRIL, MAY 1972. McElroy, W. N. (comp.). (Hanford Engineering Development Lab., Richland, Wash. (USA)). Jun 1972. Contract AT(45-1)-2170. 140p. Dep. NTIS $10.00.

The technical progress made in the Interlaboratory LMFBR Reaction Rate Program during the reporting period is described. (auth)

For abstracts of individual papers see: 19236, 19811, 21094, 21135, 21161, 21162, 21247, and 21266.

21266 (HEDL-TME-72-90, pp HEDL.9-HEDL.11) EXPERIMENTAL FISSION YIELDS FOR ^{137}Cs AND ^{148}Nd RELATIVE TO ^{140}Ba FROM NEUTRON DOSIMETRY FISSION FOIL IRRADIATIONS IN EBR-II. Matsumoto, W. Y.; McElroy, W. N. Jun 1972.

In LMFBR reaction rate and dosimetry 4th quarterly progress report, March, April, May 1972. (Hanford Engineering Development Lab., Richland, Wash. (USA)).

21267 (HEDL-TME-74-45) LMFBR REACTION RATE AND DOSIMETRY 9TH PROGRESS REPORT FOR PERIOD OCTOBER 1973–MAY 1974. McElroy, W. N. (comp.). (Hanford Engineering Development Lab., Richland, Wash. (USA)). Nov. 1974. Contract AT(45-1)-2170. 275p. AT.

Technical progress made in the Interlaboratory LMFBR Reaction Rate Program during the reporting period is described. Separate sections are listed and indexed separately in NSA. (CES)

For abstracts of individual sections see: 19781, 21059, 21136, 21268–21277, and 21302.

21268 (HEDL-TME-74-45, pp ANC.42-ANC.46) FISSION PRODUCT REACTION RATES FOR ^{235}U IRRADIATED BY THERMAL NEUTRONS AT NBS. Helmer, R. G.; Greenwood, R. C. Nov 1974.

In LMFBR reaction rate and dosimetry 9th progress report for period October 1973–May 1974. (Hanford Engineering Development Lab., Richland, Wash. (USA)).

21269 (HEDL-TME-74-45, pp ANL.1-ANL.8) ABSOLUTE FISSION RATE MEASUREMENTS BY THE TRACK RECORDER TECHNIQUE. Popek, R. J.; Dudey, N. D. Nov 1974.

In LMFBR reaction rate and dosimetry 9th progress report for period October 1973–May 1974. (Hanford Engineering Development Lab., Richland, Wash. (USA)).

21270 (HEDL-TME-74-45, pp ANL.9-ANL.12) REACTION RATES IN CFRMF (SERIES 3) BY FOIL ACTIVATION. Popek, R. J.; Dudey, N. D. Nov 1974.

In LMFBR reaction rate and dosimetry 9th progress report for period October 1973–May 1974. (Hanford Engineering Development Lab., Richland, Wash. (USA)).

21271 (HEDL-TME-74-45, pp ANL.13-ANL.15) REACTION RATE IN NBS THERMAL NEUTRON ENVIRONMENT. Popek, R. J.; Dudey, N. D. Nov 1974.

In LMFBR reaction rate and dosimetry 9th progress report for period October 1973–May 1974. (Hanford Engineering Development Lab., Richland, Wash. (USA)).

21272 (HEDL-TME-74-45, pp HEDL.35-HEDL.40) REACTION RATE MEASUREMENTS. Kellogg, L. S.; McElroy, W. N. Nov 1974.

In LMFBR reaction rate and dosimetry 9th progress report for period October 1973–May 1974. (Hanford Engineering Development Lab., Richland, Wash. (USA)).

21273 (HEDL-TME-74-45, pp LASL.1-LASL.5) REACTION RATE MEASUREMENTS IN CFRMF. Barr, D. W. Nov 1974.

In LMFBR reaction rate and dosimetry 9th progress report for period October 1973–May 1974. (Hanford Engineering Development Lab., Richland, Wash. (USA)).

21274 (HEDL-TME-74-45, pp MOL.12-MOL.24) RADIOMETRIC FISSION YIELD MEASUREMENTS IN THE MOL AND ILRR BENCHMARK NEUTRON FIELDS. Kamboj, B. K.; Fabry, A. Nov 1974.

In LMFBR reaction rate and dosimetry 9th progress report for period October 1973–May 1974. (Hanford Engineering Development Lab., Richland, Wash. (USA)).

21275 (HEDL-TME-74-45, pp NBS.1-NBS.13) ABSOLUTE FISSION CHAMBER MEASUREMENTS IN CFRMF. Grundl, J. A.; Rogers, J. W. Nov 1974.

In LMFBR reaction rate and dosimetry 9th progress report for period October 1973–May 1974. (Hanford Engineering Development Lab., Richland, Wash. (USA)).

21276 (HEDL-TME-74-45, pp NBS.19-NBS.35) MEASUREMENT OF ^{235}U THERMAL NEUTRON FISSION YIELDS. Gilliman, D. M.; Grundl, J. A.; Spiegel, V. Jr. Nov 1974.

In LMFBR reaction rate and dosimetry 9th progress report for period October 1973–May 1974. (Hanford Engineering Development Lab., Richland, Wash. (USA)).

21277 (HEDL-TME-74-45, pp NBS.36-NBS.44) COMPARISON WITH FISSION YIELDS IN CFRMF AND WITH ENDF/B IV DATA. Gilliman, D. M. Nov 1974.

In LMFBR reaction rate and dosimetry 9th progress report for period October 1973–May 1974. (Hanford Engineering Development Lab., Richland, Wash. (USA)).

21278 (IEA-366) ANGULAR DISTRIBUTION OF PHOTO FISSION FRAGMENTS IN ^{238}U AT 5.43 MeV. Kuniyoshi, S.; Mafra, O. Y.; Renner, C.; Goldemberg, J. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Dec 1974. 12p. Dep. NTIS (US Sales Only) $4.00.

The angular distribution of photofission fragments of ^{238}U, produced by 5.43-MeV monochromatic photons from the (n,γ) reaction in sulfur, was measured by using glass plates as detectors. In the analysis of the results only the contributions from the $(J^{\pi},K) = (1^-,0)$, $(1^-,1)$ and $(2^+,0)$ terms were considered. The coefficients of the angular distributions of the fission fragments were obtained. An analysis of the data available in the literature on the angular distribution near the photofission threshold is also presented. (7 figures) (auth)

21279 (IFA-NR-46-1973) MULTILEVEL CALCULATION OF THE ^{235}U NEUTRON FISSION CROSS SECTION USING THE RANK ANNIHILATION METHOD. Mihailescu, I. M.; Petrascu, M. (Institutul de Fizica Atomica, Bucharest (Romania)). 1973. 12p. INIS.

A theoretical calculation of ^{235}U fission cross-section for low-energy neutrons is presented. A single neutron channel, a single fission channel and many capture channels are taken into account. The rank annihilation method is used, which avoids the inversion of the level matrix. The ^{235}U fission cross section values computed with a FORTRAN IV program are compared with those obtained using the Reich–Moore multilevel formula. By using the same resonance parameters a good fit was obtained. (auth)

21280 (IFA-NR-48-1973) TWO-CHANNEL-MULTILEVEL CALCULATION OF THE ^{235}U NEUTRON FISSION CROSS-SECTION. Mihailescu, I. M.; Petrascu, M. (Institutul de Fizica Atomica, Bucharest (Romania)). 1973. 12p. INIS.

The ^{235}U fission cross section is calculated for low-energy neutrons by using the Reich–Moore formalism. A single neutron channel, two fission channels and many capture channels were taken into account. The fission cross-section values, computed with a FORTRAN IV program, were represented in a figure. We have considered the contribution of two bound levels, by using a Breit–Wigner formula, and of nine resonance levels at positive energy of the same spin and parity which interfere. In the same figure, the fission cross-section curve, assuming a single fission channel, was drawn. (auth)

21281 (KIYI-20) CALCULATING THE YIELDS OF VARIOUS ISOTOPES ON IRRADIATING THORIUM IN A REACTOR. Rudishin, V. K.; Fedorova, A. F. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1974. 32p. (In Russian). INIS.

The results of calculating the accumulation of various isotopes on irradiating thorium with thermal neutron fluxes phi = 10^{13} n/cm^2.sec and phi = 10^{14} n/cm^2.sec are presented. Nuclear constants

of isotopes participating in the thorium cycle have been estimated. The calculational program for use on a BESM-4 computer is given. (auth)

21282 (NP-20480(P8), pp 113-117) MASS ASYMMETRY IN THE FISSION OF ACTINIDE NUCLEI. Yamaji, S.; Iwamoto, A.; Suekane, S.; Harada, K. Dec 1974.
In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

21283 (ORNL-5025, pp 36-37) TRANSFER AND COMPOUND-NUCLEUS REACTIONS THAT LEAD TO THE NUCLEI ^{248}Cf AND ^{244}Cf: INTERACTIONS OF ^{12}C WITH ^{239}Pu AND ^{238}U. Hahn, R. L.; Dittner, P. F.; Toth, K. S.; Keller, O. L. Jr. May 1975.
In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).
As part of a continuing program to study nuclear reaction mechanisms in actinide elements, the reactions ^{239}Pu(^{12}C,alpha 2n-alpha 3n) and ^{238}U(^{12}C,5n-6n) leading to ^{248}Cf and ^{244}Cf were studied by measuring excitation functions and recoil range and angular distributions. The results are consistent with models of transfer reactions in which an aggregate is transferred to the target nucleus from the projectile, followed by evaporation of neutrons from the resulting heavy nucleus. (1 figure) (SDF)

21284 (ORNL-5025, pp 60) ATTEMPTED SYNTHESIS AND IDENTIFICATION OF ELEMENT 106. Bemis, C. E. Jr.; Dittner, P. F.; Hensley, D. C.; Hahn, R. L.; Keller, O. L.; Tarrant, J. R.; Hunt, L. D. May 1975.
In Physics Division annual progress report for period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).
An attempt has been made to produce element 106 via the reaction ^{249}Cf(^{18}O,4n). Two new alpha groups were observed at 9.06 and 9.25 MeV having a half-life of 0.74 ← 0.23 sec which has been ascribed to the alpha decay of element 106. The results are consistent with a recently published report on the discovery of element 106. (1 figure) (SDF)

21285 (UCID-16841) TRANSACTINIUM NUCLEAR CROSS SECTION MEASUREMENTS AT THE LLL 100-MeV LINAC. Browne, J. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 10 Jul 1975. 12p. Dep. NTIS $4.00.
The purpose of this report is to provide information to the Advisory Group Meeting on Transactinium Isotope Nuclear Data concerning recent results and plans for future work in this field at the Livermore 100-MeV linac. This meeting will be convened by the IAEA in cooperation with the OECD Nuclear Energy Agency at the Kernforschungszentrum Karlsruhe from 3 to 7 November 1975. In this report fission cross section ratios, ^{248}Cm fission cross section, and future plans for transplutonium measurements are discussed, and recommendations for other measurements are made. No data are given in this report. (RWR)

21286 (UCRL-77103) DISCOVERY OF ^{250}Fm. Hoffman, D. C.; Weber, J.; Wilhelmy, J. B.; Hulet, E. K.; Lougheed, R. W.; Landrum, J. H.; Wild, J. F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 15 Aug 1975. 6p. (CONF-750913-3). Dep. NTIS $4.00.
From 4th international transplutonium elements symposium; Baden-Baden, F.R. Germany (13 Sep 1975).
^{250}Fm, with the largest known neutron number (159) was synthesized by bombarding ^{257}Fm with 16-MeV tritons. The half-life and kinetic energy distribution of coincident fragments were measured. Fission properties of this isotope are significant in gauging the fission stability of a group of unknown isotopes extending from fermium to the postulated "island of stability" at ^{289}114. (2 figures) (SDF)

21287 (WANL-TMI-1189) EFFECT OF THE STATISTICAL FLUCTUATIONS OF FISSION WIDTH OF U^{233}. Stevens, C. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 29 Jul 1964. 10p. Dep. NTIS $4.00.
In a highly enriched, lightly moderated nuclear reactor, the manner by which the neutron capture and fission cross sections of ^{233}U are treated in the unresolved energy range is extremely important. The effect of taking into account fluctuations of the fission width Γ_f in this region is calculated. (SDF)

21288 DELAYED NEUTRON SPECTRUM FROM THE PHOTOFISSION OF URANIUM. Fukuda, K. Annu. Rep. Radiat. Center Osaka Prefect.; 15: 48-50(1974).
The energy distribution of neutrons from the short-lived neutron emitters produced in the photofission of natural uranium has been studied with a ^{3}He counter. A continuous energy distribution was obtained with five shoulders in the energy region of 0.2 to 0.8 MeV. A line plot of the fifth root of number of neutrons as a function of neutron energy above 1 MeV indicates two extrapolated neutron energies of about 1.6 and 4.4 MeV. (4 figures) (auth)

21289 PROTON AND DEUTERON FISSION OF ^{238}U. Kandil, A. T.; Choppin, G. R. (Florida State Univ., Tallahasee). Egypt. J. Chem.; No. Special Issue, 1-7(1973).
The peak-to-valley ratios as a function of bombarding particle energy have been measured for the fission of ^{238}U by protons and deuterons. The measurements were made in 250 KeV steps in an energy range 8 to 12 MeV. The breaks observed in these measurements have been tentatively assigned to the onset of various competing reactions such as (p,pn), (p,2n), (d,dn), (d,3n). The difference between peak-to-valley ratios measured by semiconductor detectors and those measured radiochemically has been investigated. (1 table, 3 figures) (auth)

21290 RELATIVE YIELDS OF STABLE CADMIUM ISOTOPES IN NEUTRON INDUCED FISSION. De Laeter, J. R. (West Australian Inst. of Tech., South Bently); Thode, H. G. Can. J. Phys.; 53: No. 8, 775-785(15 Apr 1975).
The relative fission yields of the five stable isotopes of cadmium (^{111}Cd, ^{112}Cd, ^{113}Cd, ^{114}Cd, and ^{116}Cd) produced in the thermal epicadmium fission of ^{233}U and ^{235}U and the epicadmium fission of ^{238}U have been measured by solid source mass spectrometry. Nanogram sized samples of fission product cadmium were analyzed to give a range of yields on the low mass side of symmetric fission. The results indicate that the mass yield distribution for thermal induced fission is relatively flat within five mass units of the valley of symmetry. The epicadmium induced fission results show enhanced yields at mass 111, the degree of enrichment depending on the mass of the fissioning nucleus. The only significant fine structure occurs at mass 113 for the epicadmium induced fission of ^{235}U. Although less certain, there is also a suggestion of a depressed yield at mass 113 for thermal neutron induced fission of ^{235}U as well. No evidence of a symmetric peak was observed in any of the data. The absence of significant fine structure in this mass range suggests that the average number of neutrons emitted per fission event varies fairly smoothly with mass. (auth)

21291 SEARCH FOR FISSIONING ISOMERS OF ^{237}U AND ^{236}Np BY USING 14.8 MeV PULSE NEUTRONS. Takekoshi, E.; Tsukihashi, Y. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Bull. Inst. Chem. Res., Kyoto Univ.; 52: No. 1, 137-141(Jul 1974).
Search for fissioning isomers of ^{237}U and ^{236}Np was made by using the ^{238}U(n,2n) and ^{237}Np(n,2n) reactions with 14.8 MeV pulse neutrons, in the region of half-lives over 60 μs. The upper limits of $\sigma_{delayed}/\sigma_{prompt}$-values were obtained to be about 1×10^{-6} for both ^{237}U and ^{236}Np fissioning isomers with the region of half-lives studied. (auth)

21292 INVESTIGATION OF THE REPORTED MASS DISTRIBUTION CURVES IN THE FISSION OF ^{232}U WITH 14.8 MeV NEUTRONS. James, W. D.; Adams, D. E.; Beck, J. N.; Kuroda, P. K. (Univ. of Arkansas, Fayetteville). J. Inorg. Nucl. Chem.; 37: No. 6, 1341-1342(Jun 1975).
The mass yield distribution of fission products produced in the fission of ^{232}U with 14.8 MeV neutrons has been measured for eight mass chains in the symmetric region. This investigation was initiated to resolve existing discrepancies in published data with respect to the fission yields in the valley region and the peak-to-valley ratio. The absolute activities of the nuclides measured were determined from gross beta counting and total yields were measured relative to ^{132}Te or ^{99}Mo. The standard yields were chosen due to the close agreement of previous data for those mass chains. The peak-to-valley ratio calculated was about 3.5. The fission yields measured in this work have been compared to known existing values for 14.8 MeV neutron-induced fission of ^{233}U. (auth)

21293 SEARCH FOR TRANSURANIUM ELEMENTS AND THEIR PREPARATION. Flerov, G. N. Fiz. Sz.; 24: No. 7, 197-202(Jul 1974). (In Hungarian).
From 4th international conference on peaceful uses of atomic energy; Geneva, Switzerland (1971).
Methods of producing and investigating new transuranium elements are analysed. A brief analysis is given of the three stages in the development of research on the subject of transuranium elements. The results of work at the Nuclear Reactions Laboratory on the synthesis and investigations of isotopes of elements 102-105 are discussed. It is shown how physical and chemical studies led to the experimental delimitation of the actinide group of elements and how information was obtained on their radioactive decay pattern. The paper includes a review of future prospects in the search for and synthesis of far transuranium elements in a new stability region with $106 \leq Z \leq 128$ ($N \sim 184$). The results of a search for spontaneous fission in isotopes of super-heavy elements are discussed. Possible trends in further work devoted to the search for and identification of far transuranium elements are considered, for example measuring the number

of units per spontaneous fission event in the super-heavy elements. Ways of synthesizing and identifying far transuranium elements by methods involving the use of accelerated ions heavier than argon (for example, Zr, Kr and Xe) are discussed. It is shown that when ions heavier than Xe are used, fission may be a promising method of synthesizing super-heavy elements. (auth)

21294 STRUCTURE IN THE ENERGY DEPENDENCE OF ν/ avg/ FOR ^{235}U FISSION. Seregina, E. A.; D'yachenko, P. P.; Kuz'minov, B. D. Sov. At. Energy (Engl. Transl.); 37: No. 6, 1282-1283(Dec 1974).

Translated from At. Energ. (USSR); 37: No. 6, 500-501(Dec 1974).

The mass and kinetic energy distributions of fragments were measured for fission of ^{235}U by neutrons in an energy range from 450 to 610 keV. Average energies and widths of the spectra of neutrons produced by fission were determined theoretically and experimentally. An analysis was made, within the framework of fission energy balance, of the average number of neutrons. It is concluded that the fine structure in the average number of neutrons cannot be explained from the viewpoint of the redistribution of fission energy between the kinetic energy and the excitation energy of the fragments. (1 figure) (SDF)

Nuclear Theory

Refer also to abstracts 20968, 21078, 21119, 21223, 21258, and 21259.

21295 (COO-2130-163, pp 1-23) WHY SHOULD ANYONE STUDY HEAVY-ION REACTIONS. 1973.

In heavy ion lecture series, 1972-73, Volume II.

Two kinds of experiments that can be performed with heavy ions are discussed. The first is the population of high angular momentum states using the fact that the heavy ion brings in a lot of angular momentum, and the second is the study of states made up of multi-particle excitations. (LBS)

21296 (COO-2130-163, pp 133-152) POINT CHARGED PARTICLES: BORN AND BEA APPROACHES. 1973.

In heavy ion lecture series, 1972-73, Volume II.

The use of the binary encounter approximation in the computation of inner shell vacancy production is considered. Comparisons are made with Born approximation results. (10 figures) (SDF)

21297 (COO-2130-163, pp 153-170) STRUCTURE PROJECTILES: THEORETICAL MODELING. 1973.

In heavy ion lecture series, 1972-73, Volume II.

A discussion of differences in production of inner shell vacancies for ions heavier than alpha particles, compared to protons and alpha particles is presented. A theoretical account is given, and the problem of fluorescence yield is considered. (6 figures) (SDF)

21298 (COO-2130-163, pp 208-239)) TWO-CENTER SHELL MODEL. 1973.

In heavy ion lecture series, 1972-73, Volume II.

An asymptotically well behaved shell model is discussed mostly from the point of view of fission reactions. The model is basically of double oscillator nature with spin orbit and l^2 terms added. Various aspects including the mass distribution in asymmetric fission are discussed. (24 figs.) (SDF)

21299 (COO-2130-163, pp 305-328)) COULOMB-INDUCED AND TRIPLE FISSION. 1973.

In heavy ion lecture series, 1972-73, Volume II.

Aspects of heavy ion physics, including Coulomb fission, super-heavy elements, and triple fission are considered. (9 figures) (SDF)

21300 (COO-2171-53) NUCLEAR STRUCTURE THEORY. Annual Technical Progress Report, 1 July 1974--30 June 1975. French, J. B.; Koltun, D. S. (Rochester Univ., N. Y. (USA). Dept. of Physics and Astronomy). 1975. Contract AT(11-1)-2171. 12p. Dep. NTIS $4.00.

Progress during the past year is summarized for the following areas of nuclear structure and reaction theory: Meson interactions with nucleons and nuclei, including inelastic scattering of pions, three-body theories of scattering and absorption of pions by deuterons, and pi-p bremsstrahlung. Theory of the effective interaction, including behavior of the expansion in orders of the reaction matrix. Statistical spectroscopy including fluctuations in energy levels and excitation strengths, and sum rules and strength distributions for various excitation processes, including single-nucleon transfer, beta decay and multipole giant resonances. Studies of the inverse scattering problem. Studies of nuclear symmetries, of nuclear clustering, and of general nuclear structure by alpha-transfer reactions, and of nuclear shapes by (d,^{3}He) reactions. (auth)

21301 (COO-3001-119) ABNORMAL STATES OF NUCLEAR MATTER. Castillejo, L. (State Univ. of New York, Stony Brook (USA)). 1975. Contract AT(11-1)-3001. 13p. (CONF-750631-11). Dep. NTIS $4.00.

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975).

Results for abnormal states in nuclear matter are reviewed and compared with pi$^-$ condensates in the context of chiral invariance and the sigma model. The relative importance of symmetry breaking and conserving interactions is assessed for the two problems. Vacuum self-energy effects are crucial in abnormal matter calculations particularly when finite size abnormal nuclei are considered. (7 figures) (auth)

21302 (HEDL-TME-74-45, pp HEDL.41-HEDL.48) CALCULATION OF REACTION RATES IN THE CFRMF SPECTRUM. Lippincott, E. P.; McElroy, W. N. Nov 1974.

In LMFBR reaction rate and dosimetry 9th progress report for period October 1973-May 1974. (Hanford Engineering Development Lab., Richland, Wash. (USA)).

21303 (HU-TFT-75-8) SATURATING EFFECT OF THE $\Delta(1236)$ IN NUCLEAR MATTER. Green, A. M.; Niskanen, J. A. (Helsinki Univ. (Finland). Research Inst. for Theoretical Physics). Mar 1975. 41p. Dep. NTIS (US Sales Only) $5.25.

It is shown that the explicit introduction of the $\Delta(1236)$ into the two nucleon interaction gives rise in nuclear matter to a repulsive contribution to the binding energy of 5 MeV per particle at $k_F = 1 \cdot 4$ fm^{-1}. This contribution increases approximately as the square of the density. The effect is found using both the Pandharipande and Brueckner approaches with quantitative agreement between the two. A brief discussion is made of the compensating three-body force contribution. (8 figures, 8 tables) (auth)

21304 (IC-74-91) SHORT-RANGE CORRELATIONS WITH PSEUDOPOTENTIALS. Pt. 1. Osman, A. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1974. 18p. INIS.

Short-range correlations in nuclei are considered. The nucleon-nucleon interaction is separated into two parts: the short-range part, which contributes to the strong repulsive forces between nucleons, and the long-range attractive part. To achieve healing in the correlated wave function, a short-range pseudopotential is introduced. This separation is applied for some nucleon-nucleon interactions. The binding energies per particle in the spherical nuclei ^{16}O and ^{40}Ca are presented with this separation for the Hamada-Johnston, the Yale, and the Reid potentials and for a nucleon-nucleon potential calculated in the present work according to meson exchange between nucleons. (INIS)

21305 (IC-74-92) SPECTROSCOPIC FACTORS FOR (d,p) STRIPPING REACTIONS WITH DIFFERENT REPULSIVE CORE NUCLEON-NUCLEON POTENTIALS. Osman, A.; Zaky, M. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1974. 23p. INIS.

Deuteron stripping reactions are considered. The short-range correlations for the nucleons in the nuclei are taken into account. The neutron-proton nuclear potential in the deuteron is taken as a long-range attractive potential surrounded by a short-range repulsive potential. Different forms for the two parts of the neutron-proton nuclear potential are taken. The differential cross-sections for the two nuclear reactions $^{28}Si(d,p)^{29}Si$ and $^{40}Ca(d,p)^{41}Ca$ have been calculated for each of the nuclear potential forms. Fitting our theoretical calculations, using the DWBA calculations, with the experimental data, a good agreement is obtained. The more reliable spectroscopic factors for these reactions have been extracted. (INIS)

21306 (IC-74-95) COULOMB (d,p) STRIPPING REACTIONS. Osman, A. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1974. 13p. INIS.

The theory of deuteron stripping reactions at incident energies below the Coulomb barrier has been considered. A closed analytical form for the differential cross-section has been obtained considering three cases according to the incident deuteron and outgoing proton energies. The agreement between our theoretical calculations and the experimental data is satisfactory. By fitting our theoretical calculations with the experimental data, more reliable values for the spectroscopic factors are extracted. (INIS)

21307 (IFA-DNBR-12-1974) SLBWP (SINGLE LEVEL BREIT-WIGNER PROGRAMME) FOR CROSS SECTION GENERATION IN THE RESOLVED RESONANCE REGION. Iliescu, I.; Benzi, V.; Menapace, E.; Motta, M. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 39p. (In Romanian). INIS.

This code is designed for the calculation of the neutron cross sections for elastic scattering, capture, fission and total reaction by using the Breit-Wigner approximation for a single level. Resonance-potential interference is considered; Doppler broadening and instrumental resolution broadening are optionally per-

formed by successive numerical convolutions. The resonance integrals for a reaction, between the energy points considered, are calculated using lin–lin or log–log interpolations. The programme permits the preparation of an energy grid connected with the degree of accuracy. SLBWP is written in the FORTRAN IV language for the IAP Computer IBM 370/135. (auth)

21308 (INIS-mf-1724) ON THE ANALYSIS OF UNSTABLE RESIDUAL STATES IN DIRECT NUCLEAR REACTIONS. Toledo Piza, A. F. R. de. (Sao Paulo Univ. (Brazil). Instituto de Fisica). 1972. 37-50p. INIS.

From 4th Brazilian symposium on theoretical physics; Rio de Janeiro, Brazil (4 Jan 1972).

Understanding of intermediate structure resonances and the underlying fine structure fluctuations is brought to bear on reactions in which intermediate structures are produced in the residual fragments rather than formed in the compound nucleus system. The process discussed here is that in which an energetic electron knocks a proton out of a target nucleus leaving it in a highly excited state. The central point of the analysis consists in the decomposition of the residual nuclear state into its appropriate components. (INIS)

21309 (INIS-mf-1737) HEAVY ION COLLISIONS.' Kerman, A. K. (Massachusetts Inst. of Tech., Cambridge (USA)). 1972. 67-128p. INIS.

From 4th Brazilian symposium on theoretical physics; Rio de Janeiro, Brazil (4 Jan 1972).

First, characteristics of heavy ion collisions are discussed, in particular, elastic scattering. The importance of the concept of the nuclear potential energy surface for heavy-ion processes and fission is stressed. Robson's arguments for an l-dependent optical potential, von Oertzen's arguments involving "transfer channel," and Regge analysis are discussed. The Hartree–Fock picture for heavy ion processes is presented, as are some recent developments in the theory of nuclear reactions, in particular concerning the S matrix. (auth)

21310 (JINR-E4-8847) FRAGMENTATION OF SINGLE-PARTICLE STATES AND NEUTRON STRENGTH FUNCTIONS. Soloviev, V. G. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 17p. (CONF-750555-1). Dep. NTIS (US Sales Only) $4.00.

From 3rd national soviet conference on neutron physics; Kiev, USSR (26 May 1975).

The fragmentation of single-particle states in odd-A deformed nuclei is studied in the framework of the quasi-particle–phonon interaction model. A fundamentally new semi-microscopic method of calculating the strength functions, which is based on single-particle fragmentation, is suggested. The values for the s- and p-wave neutron strength functions for ^{239}U and ^{169}Er are obtained which are in good agreement with experiment. A description of the s-wave neutron strength function in the range of its minimum, in particular, for isotopes of Sn, is obtained. (auth)

21311 (LBL-4203) FRAGMENTATION OF RELATIVISTIC NUCLEI. Cork, B. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1975. Contract W-7405-eng-48. 29p. (CONF-750655-1). Dep. NTIS $4.50.

From 6th international conference on high energy physics and nuclear structure; Albuquerque; New Mexico, USA (8 Jun 1975).

Nuclei with energies of several GeV/n interact with hadrons and produce fragments that encompass the fields of nuclear physics, meson physics, and particle physics. Experimental results are now available to explore problems in nuclear physics such as the validity of the shell model to explain the momentum distribution of fragments, the contribution of giant dipole resonances to fragment production cross sections, the effective Coulomb barrier, and nuclear temperatures. A new approach to meson physics is possible by exploring the nucleon charge-exchange process. Particle physics problems are explored by measuring the energy and target dependence of isotope production cross sections, thus determining if limiting fragmentation and target factorization are valid, and measuring total cross sections to determine if the factorization relation, sigma/sub AB/^{2} equals sigma/sub AA/. sigma/sub BB/, is violated. Also, new experiments have been done to measure the angular distribution of fragments that could be explained as nuclear shock waves, and to explore for ultradense matter produced by very heavy ions incident on heavy atoms. (12 figures, 2 tables) (auth)

21312 (NP-20480(P8), pp 58-60) ONE- AND TWO-STEP PROCESSES IN THE HEAVY-ION INDUCED TWO-NUCLEON TRANSFER REACTION. Kammuri, T. Dec 1974.

In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

21313 (NP-20480(P8), pp 64-67) FOLDING MODEL FOR NUCLEUS–NUCLEUS OPTICAL POTENTIAL. Kammuri, K.; Wada, T. Dec 1974.

In IPCR cyclotron progress report, 1974. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)).

21314 (ORNL-5025, pp 10-11) PHENOMENOLOGICAL SELF-CONSISTENT FIELD MODEL. Cusson, R. Y.; Kolb, D. May 1975.

In Physics Division annual progress report for the period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

A new, more realistic reaction matrix model of the self-consistent field has been developed and applied to the calculation of single particle energies for ^{208}Pb. A new code has also been written to complement this improved model and provide for iterative computation of the self-consistent total energy within an input constraint (density asymmetry). Results for the ^{16}O + ^{208}Pb system are shown. (2 figures) (SDF)

21315 (ORNL-5025, pp 14-15) MICROSCOPIC DESCRIPTIONS OF GIANT MULTIPOLE RESONANCES. Becker, R. L.; McGrory, J. B.; Halbert, E. C.; Satchler, G. R.; Speth, J. May 1975.

In Physics Division annual progress report for the period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

Giant multipole resonances have been studied in closed shell nuclei using random phase approximation methods. Results are shown for the inelastic scattering of protons by ^{208}Pb. Contributions from the various multipoles are considered, particularly the monopole oscillation. As an alternate approach, a shell model calculation has been performed for ^{16}O using Brueckner G matrix elements calculated from the Hamada-Johnston potential. Although this calculation does not lead to the observed excitation spectrum, it does lead to quadrupole and monopole states. (3 figures) (SDF)

21316 (ORNL-5025, pp 17-19) MULTISTEP PROCESSES IN DIRECT REACTIONS. Rickertsen, L. D. May 1975.

In Physics Division annual progress report for the period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

The general reaction code CHUCK provides a solution for a set of simultaneous second order differential equations under the appropriate boundary conditions. Calculations using CHUCK are being made for inelastic scattering cross sections of ^{12}C on ^{144}Nd, ^{12}C on ^{12}C, and a study of the contribution from the (^{3}He,alpha), (alpha,t) two-step process to the angular distribution in (^{3}He,t) reactions. It is found that the distorting potentials in intermediate channels of the two-step process have a considerable influence on both the shape and magnitude of the final angular distributions. (1 figure) (SDF)

21317 (ORNL-5025, pp 19-20) NUCLEUS–NUCLEUS OPTICAL POTENTIALS. Owen, L. W.; Satchler, G. R. May 1975.

In Physics Division annual progress report for the period ending December 31, 1974. (Oak Ridge National Lab., Tenn. (USA)).

The properties of the nucleus–nucleus optical potential that can be inferred from analysis of elastic scattering data are investigated. The study includes ORNL data from ^{11}B, ^{12}C, ^{16}O, and ^{20}Ne on ^{208}Pb; ^{12}C on ^{90}Zr; and ^{16}O on ^{58}Ni, ^{60}Ni, ^{60}Co, and ^{28}Si. Inelastic scattering and transfer reactions are also considered. Data and optical model fits using a folded real potential from a Gaussian nucleon–nucleon interaction and Woods–Saxon imaginary potential are presented for ^{16}O + ^{208}Pb. (1 figure) (SDF)

21318 (ORO-4856-12) BACKBENDING IN FAST ROTATING NUCLEI AND GAPLESS SUPERCONDUCTIVITY I QUALITATIVE CONSIDERATIONS. Technical Report No. 75-091. Goswami, A. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). Jun 1975. 22p. Dep. NTIS $4.25.

It is shown that the effect of coriolis antipairing on fast rotating nuclei leads to an intermediate phase of "gapless superconductivity" before the nuclei become "normal". The gapless excitations in this intermediate phase give rise to "crossing bands" that have been shown to be important for the explanation of backbending. A connection is thus established between the Mottelson–Valatin and the Stephens' approach to this problem. The mathematics of our theory is based on a self-consistent perturbation treatment of the pairing force within the context of the single particle equation of motion method. (auth)

21319 (ORO-4856-14) REACTIVE CONTENT OF THE SINGLE SCATTERING OPTICAL POTENTIAL. Tandy, P. C.; Redish, E. F.; Bolle, D. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). Jun 1975. 11p. Dep. NTIS $4.00.

A unitarity relation is derived for the nucleon-nucleus scattering amplitude which displays the reaction mechanisms associated with the absorptive part of the single scattering optical potential. The reactions implicit in the absorption are nucleon pickup and knockout. The transition amplitudes for these processes are extracted from the unitarity relation and their accuracy is discussed. (auth)

21320 (ORO-4856-15) EFFECTS OF ROTATION ON THE STABILITY OF NUCLEI UNDER FISSION AND THE POSSIBILITY

OF FUSION IN HEAVY-ION REACTIONS. Mustafa, M. G.; Kumar, K. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). Jun 1975. 33p. Dep. NTIS $4.75.

The two-center shell model for fission is extended to include the effects of nuclear rotation or angular momentum J. The principle of minimization of total nuclear energy with respect to a constraint on J leads to an effective potential energy which depends on J as well as moment of inertia. This effective potential energy is minimized with respect to nuclear shape variables, neutron pairing energy gap, and proton pairing energy gap for each J value. The resulting potential minima, fission barriers, and moments of inertia are quite sensitive to J. Results are given for $^{208}_{82}$Pb, $^{240}_{94}$Pu, and for a super-heavy nucleus, $^{298}_{114}$X. Microscopic calculations of the critical angular momentum (at which the fission barrier vanishes) are compared with the rotating liquid drop calculations of Cohen, Plasil, and Swiatecki. The influence of these results on the possibility of fusion in heavy-ion reactions is discussed. (5 figures, 6 tables) (auth)

21321 (ORO-4856-18) VARIATIONAL PRINCIPLE FOR THE BLOCH UNIFIED REACTION THEORY. MacDonald, W.; Rapheal, R. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). 1975. 16p. Dep. NTIS $4.00.

The unified reaction theory formulated by Claude Bloch uses a boundary value operator to write the Schroedinger equation for a scattering state as an inhomogeneous equation over the interaction region. As suggested by Lane and Robson, this equation can be solved by using a matrix representation on any set which is complete over the interaction volume. Lane and Robson have proposed, however, that a variational form of the Bloch equation can be used to obtain a "best" value for the S-matrix when a finite subset of this basis is used. The variational principle suggested by Lane and Robson, which gives a many-channel S-matrix different from the matrix solution on a finite basis, is considered first, and it is shown that the difference results from the fact that their variational principle is not, in fact, equivalent to the Bloch equation. Then a variational principle is presented which is fully equivalent to the Bloch form of the Schroedinger equation, and it is shown that the resulting S-matrix is the same as that obtained from the matrix solution of this equation. (auth)

21322 (WANL-TMI-475) PREPARATION OF INELASTIC SCATTERING DATA FOR USE IN MONTE CARLO CODE 18-0. Drawbaugh, D. W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 4 Feb 1963. 3p. Dep. NTIS $4.00.

Preparation of inelastic scattering data using the Monte Carlo code 18-0 is briefly illustrated with a calculation of transition probabilities for titanium. (SDF)

21323 (ZFK-276) WEAK COUPLING MODEL FOR DEFORMED NUCLEI, APPLIED TO THE NUCLEUS ^{29}Si. Wiebicke, H. J.; Muenchow, L. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). May 1974. 19p. (In German). Dep. NTIS (US Sales Only) $4.00.

A model of weak coupling of an even-even rotating core-nucleus and an odd particle is formulated. The connection with the strong coupling model (Nilsson model with Coriolis interaction) is shown. The conception of weak coupling is applicable especially for transition nuclei, which have a potential surface with minimum values at prolate and oblate deformations. The model is used to calculate the energy spectrum of the nucleus ^{29}Si up to 5 MeV excitation energy. By fitting to the experimental spectrum the coupling strength between particle and core is found and expressed as an effective deformation, which is shown to be much smaller than the equilibrium deformation. This difference is interpreted as a measure of the deviation of the core from the ideal rotator. This simple model gives a good agreement between the calculated energy spectrum and the experimental one. (4 figures) (auth)

21324 PIONIZATION EFFECT ON THE FORMATION OF HIGH-DENSITY NUCLEAR MATTER IN HEAVY-ION COLLISIONS. Kitazoe, Y.; Sano, M.; Toki, H. (Osaka Univ.). Lett. Nuovo Cim.; 13: No. 4, 139-144(24 May 1975).

The calculations for the possibility of high density matter formation in an intermediate stage of heavy ion reactions at high energies including the effects of the heat energy and nucleon density in a compressed nucleus are reported. The effect of meson production on the formation of high temperature and high density nuclear matter is explored. It is pointed out that the compressed density cannot exceed four times the normal one so long as the freedom of only nucleons is considered and can become higher than four times when the freedom of meson production is additionally taken into account. (JFP)

21325 THREE-PARTICLE CLUSTER CORE COUPLING MODEL. Vanden Berghe, G. Meded. K. Acad. Wet., Lett. Schone Kunsten Belg., Kl. Wet.; 36: 1-64(1974).

In order to describe level schemes and electromagnetic properties of atomic nuclei, a model is proposed in which three valence particles are coupled to harmonic quadrupole vibrations of a core. Both the pairing force and the surface delta interaction are discussed. Two cases are considered; (i) there is no restriction on the dynamical characteristics of the particles, and (ii) the three particles are identical. In the first case, a second quantized formalism is used, and for case (ii), the antisymmetric three particle wave function is expanded with the aid of fractional-parentage coefficients. (37 references) (SDF)

21326 GENERALIZED FACTORIZATION THEOREM FOR THE EFFECTIVE CHARGE. Paar, V. (International Centre for Theoretical Physics, Trieste, Italy). Lett. Nuovo Cim.; 13: No. 2, 55-59(10 May 1975).

For transition and static E2 moments of single-particle nuclear states the first-order induced collective contributions can be trivially incorporated into the single-particle charge renormalization. This result is generalized for irreducible diagrams to any order of the perturbation expansion. The diagrams contributing to the E2 moment between the single-particle states which involve direct interaction of a single particle with an electromagnetic field are considered. (JFP)

21327 COMPARISON OF FADDEEV METHOD AND RESONATING GROUP METHOD ABOVE BREAKUP THRESHOLD. Sohre, F.; Schmid, E. W. (Tuebingen Univ. (F. R. Germany). Inst. fuer Theoretische Physik). Z. Naturforsch., A; 30: No. 3, 271-273(Mar 1975).

2 figs.; 7 refs.

The reliability of the resonating group method is studied above the three-body breakup threshold. In particular, the real part of the elastic n-d phase shift is calculated in a model of spinless bosons interacting by a separable Yamaguchi potential for which exact Faddeev results are available. Spurious singularities which are caused by the distortion part of the resonating group ansatz are eliminated by a least squares method. (GE)

21328 THEORY OF THE OPTICAL POTENTIAL FOR EVEN-EVEN DEFORMED NUCLEI. Knyazkov, O. M.; Sorokin, A. I. (Leningrad State Univ.). Ann. Phys. (Leipzig); 31: No. 3, 227-238(Sep 1974).

Optical-model potentials are constructed for nucleon-nucleus scattering. The contribution of collective states to the imaginary part of the optical potential is investigated; the interaction between the incident nucleon and an even-even deformed target nucleus is considered in the weak coupling scheme of the Semi-phenomenological Model of the Nucleus. The potentials constructed are in good agreement with the phenomenological ones. Numerical estimates are given for the target nucleus ^{156}Gd at the incident energy 16 Mev. (1 fig., 1 table) (auth)

21329 SEMIPHENOMENOLOGICAL MODEL APPROACH TO CONTINUOUS SPECTRUM STATES. I. Knyazkov, O. M.; Krutov, V. A.; Maximatchev, J. V. (Leningrad State Univ.). Ann. Phys. (Leipzig); 31: No. 3, 197-215(Sep 1974).

The Semiphenomenological Model of the Nucleus (SPM) is applied to describing the mechanisms of the inelastic and elastic scattering of nucleons by nuclei. Perturbation theory for the SPM "residual" interaction (including the first and second order) is used as calculational method. Cross sections, angular distributions, widths of resonant states and the imaginary part of optical potential are considered in a unified manner (one-step and two-step transitions being taken into account). Numerical estimates are given for the target nucleus ^{41}Ca, quasiparticle states being taken as intermediate ones. (6 tables) (auth)

21330 SEMIPHENOMENOLOGICAL MODEL APPROACH TO CONTINUOUS SPECTRUM STATES. II. Krutov, V. A.; Sorokin, A. I. (Leningrad State Univ.). Ann. Phys. (Leipzig); 31: No. 3, 216-226(Sep 1974).

The Semiphenomenological Model of the Nucleus (SPM) is applied to description of inelastic nucleon scattering with excitation of rotational states. Cross sections of inelastic scattering of protons with E = 6 Mev by ^{56}Fe with excitation of the states $I^{\pi}K = 2^{+}0$ and $I^{\pi}K = 2^{+}2$ are calculated for illustration. The total deformation and non-axiality parameters are derived and compared with predictions of SPM, the agreement being satisfactory. (3 figures) (auth)

21331 FUSION IGNITION OF MICROFISSION EXPLOSIONS. Baird, G. E. (Univ. of Mississippi, University). Nature (London).; 253: No. 5492, 525(13 Feb 1975).

It has been suggested that microexplosions could be caused in very small amounts of fissionable materials by imploding the material until it is 200 to 300 times its normal density, using a high energy laser pulse. For a chain reaction to commence, however, neutrons must be present to initiate the fission process.

For a small critical mass of U, say 0.34g, and a hydrodynamic disassembly time of 10^{-9} sec., conventional neutron sources will not be suitable to initiate a chain reaction, but the use of neutrons from a D–T mixture placed in the core of the fissionable material seems feasible and offers several distinct advantages over conventional neutron sources. Using the D–T system, compression of the core by a laser pulse would induce thermonuclear fusion and produce 14 MeV neutrons. A D–T mixture occupying 10^{-6} of the volume of a sphere of fissionable material will give 10^{12} neutrons in 10^{-11} sec., representing a very adequate supply of neutrons to initiate the fission reaction. Advantages in applying this technique to the initiation of fusion reactions are mentioned. (UK)

21332 BOSON EXPANSION METHOD AND THE COUPLING OF DIFFERENT DEGREES OF FREEDOM. Ceausescu, V.; Raduta, A. A. (Institutul de Fizica Atomica, Bucharest (Romania)). Progr. Theor. Phys. (Kyoto); 52: No. 3, 903-927(Sep 1974).

A model for the quintuplet-collective levels 1^-, 2^-, 3^-, 4^-, 5^- observed in some spherical nuclei is proposed. The shell model Hamiltonian with pairing, quadrupole-quadrupole and octupole-octupole effective forces is expanded up to fourth order in quadrupole and octupole phonons by the Belyaev-Zelevinsky technique. In order to improve the expansion convergence the basis given by the random phase approximation (RPA) is changed by a canonical transformation determined by the condition of minimum for the ground state energy. To specify the diagonalization basis one needs the multiplicity of the R_3 irreducible representation into R_7 representation. This was calculated using Weyl's procedure. Using some specific tensor properties of fourth order terms, the collective part of the expanded Hamiltonian is written in a compact form. The contribution of the noncollective degrees of freedom on the above-mentioned levels is simulated by an effective, collective and energy-dependent Hamiltonian which is written explicitly. The eigenvalue problem of the total Hamiltonian can be solved selfconsistently. The matrix elements of the fourth order octupole-like terms as well as of the mixing terms are expressed as products of two factors, one of them bearing the entire dependence on the number of phonons. (auth)

21333 EXCITATION OF COLLECTIVE STATES IN THE NUCLEI WITH PHOTOPRODUCTION OF VECTOR MESONS. Berezhnoi, Yu. A.; Vovenko, V. P. (Physical-Technical Inst., Kharkov). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 2, 292-295(Feb 1975). (In Russian).

The excitation of low-lying vibrational states in nuclei was studied in photoproduction of vector mesons. It is shown that a comparison of theoretical and experimental cross-sections of such processes permits checking the correctness of the model of vector dominance. (1 figure) (auth)

21334 INTERACTION OF MEDIUM ENERGY DEUTERONS WITH ATOMIC NUCLEI. Berezhnoi, Yu. A.; Soznik, A. P. (Physical-Technical Inst., Kharkov). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 2, 286-291(Feb 1975). (In Russian).

A simple model is developed permitting one to describe different processes of the diffraction interaction of deuterons with medium and heavy nuclei. The results of the calculations are in agreement with the experimental data on the elastic and non-elastic scattering of deuterons with the energy of 80 MeV by zinc and lead nuclei as well as with the data on the reaction of deuteron stripping at the energy of 650 MeV. (1 figure) (auth)

21335 FAST METHOD FOR NUCLEAR COUPLED-CHANNELS CALCULATIONS INCLUDING COULOMB EXCITATION. Tolsma, L. D. (Eindhoven Univ. of Technology, Netherlands). J. Comput. Phys.; 17: No. 4, 384-400(Apr 1975).

To reduce the computation time in nuclear coupled-channels calculations including Coulomb excitation, the applicability of Gordon's numerical method was investigated to the integration range beyond the range of the nuclear potential. It turns out that a considerable reduction of computation time can be obtained. The larger the integration range and the relative wave number, pertinent to a given reaction process and reaction energy, the larger is this reduction. This is illustrated by two test cases dealing with alpha and ^{16}O scattering near the Coulomb barrier. Consequently, although the method is sometimes also of considerable advantage in the case of scattering of light particles, it seems to be especially suitable to heavy-ion scattering problems. (2 figures, 2 tables) (auth)

PHYSICS (RADIATION AND SHIELDING)

Radiation Physics

Refer also to abstracts 19282 , 19714, 19944, 20250, 20376, 20501, 20770, 20786, 20787, 20820, and 21075.

21336 (AED-CONF-75-082-001) PHYSICAL FOUNDATIONS OF RADIOPROTECTION. Habermehl, A. (Marburg Univ. (F. R. Germany). Radiologiezentrum). 1975. 14p. (In German). INIS.

From annual meeting of the Deutsche Verein fuer Versicherungswissenschaft e. V.; Karlsruhe, F. R. Germany (5 Mar 1975).

Available from ZAED.

The lecture gives a brief introduction into the physics of ionizing radiation. Besides explanations about the type and sources of ionizing radiation, their quantitative determination is briefly dealt with. Dose parameters and units are given as well as the various measuring methods. Finally, the interaction of radiation with matter is gone into which is the foundation of shielding. (GE)

21337 (BNL-20261) STOPPING OF FAST CHANNELED PARTICLES. Golovchenko, J. A. (Bell Labs., Murray Hill, N. J. (USA); Brookhaven National Lab., Upton, N. Y. (USA)). 1973. 11p. Dep. NTIS $4.00.

The use of quantum perturbation methods to calculate the random stopping at high velocities is generalized to apply to the channeling situation. Because of the great simplification of method obtained through the use of classical pictures to describe the dynamical state of channeled particles, the collisions with the crystal atoms are specified in terms of impact parameters, the distribution of which may be estimated by Lindhard's theory. (RWR)

21338 (CONF-720805-P1, pp 79-89) APPLICATION OF APOLLO COSMIC RADIATION DOSIMETRY TO LUNAR COLONIZATION STUDIES. English, R. A. (Kelsey-Seybold Clinic, Johnson Spacecraft Center, Houston, TX); Bailey, J. V.; Brown, R. D. 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

The radiation data gathered from the lunar landing missions of Apollo 11 through Apollo 15 are presented. These data have been analyzed to provide dosimetry evaluation of the ambient radiation and radiation from potential solar particle events for the planning of safe, long-term stays of relatively large numbers of individuals upon the moon. (auth)

21339 (CONF-720805-P1, pp 91-99) COSMIC RAY POPULATION EXPOSURE. Oakley, D. T. (Environmental Protection Agency, Washington, DC); Goldin, A. S. 1972.

From 2nd conference on natural radiation environment; Houston, Texas, USA (7 Aug 1972).

In natural radiation environment II. (Rice Univ., Houston, Tex. (USA); Texas Univ., Houston (USA)).

Cosmic radiation represents one of the largest sources of radiation exposure to man. Although there are estimates of cosmic ray exposure at scattered locations around the world, there has been no systematic attempt to present an overall estimate of man's exposure to this radiation source. The cosmic radiation exposure in the United States is estimated by considering the distribution of the population with elevation. (auth)

21340 (COO-3150-25) OBSERVATIONS ON THE DETERMINATION OF ELECTRON MEAN-FREE PATHS FROM RF SIZE EFFECT MEASUREMENTS. Wagner, D. K.; Cochran, R. (Cornell Univ., Ithaca, N. Y. (USA). Lab. of Atomic and Solid State Physics). Jun 1974. AT-(11-1)-3150. 13p. Dep. NTIS $4.00.

Numerical calculations of the line shape of the rf size effect for 0.1 mm thick potassium plates in the transmission geometry at 1.25 MHz show that the amplitude of the fundamental resonance is proportional to exp (-1.22d/l), while that of the second resonance is proportional to exp (-0.92d/l), where d and l are the plate thickness and electron mean-free path, respectively. In the case of the fundamental, the result differs significantly from the exp (-1.57d/l) dependence usually assumed for the purpose of determining l, and indicates that the conventional analysis leads to an overestimate of l by approximately 30 percent. The amplitude dependence found here can be explained physically in terms of the finite skin depth and, in the case of the second resonance, in terms of the strength of the electric field splash at the center of the plate. (4 figures) (auth)

21341 (ORO-2911-17) INTERACTION OF HEAVY IONS WITH MATTER. Boring, J. W.; Johnson, R. E. (Virginia Univ., Charlottesville (USA). School of Engineering and Applied Science). Jun 1975. Contract AT(40-1)-2911. 73p. Dep. NTIS $6.75.

A description is given of work performed to describe the energy dependence of radiation damage by low energy heavy particles. Experimental work on inactivation cross sections for RNase with ions of less than 10 keV is covered and the models used for averaging the biological damage over the energy loss in the material are discussed. Data are presented on cross section measurements, primary recoils, and energy losses. 6 figs. (GHT)

21342 (SAND-75-0005) ABSOLUTE DETERMINATION OF BREMSSTRAHLUNG DEPOSITION (HYDRA). Lockwood, G. J.; Miller, G. H. (Sandia Labs., Albuquerque, N. Mex. (USA)). Jun 1975. Contract AT(29-1)-789. 46p. Dep. NTIS $5.50.

A technique developed to measure electron energy deposition in metals has been applied to the determination of bremsstrahlung deposition. In this method a square-wave beam modulation is employed and the time-derivative of a calorimeter temperature is used to obtain the energy deposited. This paper presents the results of bremsstrahlung deposition measurements in gold and aluminum. Data are presented for dose to a material as a function of converter material, converter thickness, and angle of electron incidence for electron energies in the range from 0.2 to 1.0 MeV. In addition, measurements of dose as a function of calorimeter position as it was moved both laterally and axially with respect to the beam axis are reported. Utilizing the facility and technique developed to make these measurements, a thorough study of the bremsstrahlung measuring calorimeters used with the pulsed electron beam machine Hydra was accomplished. The goal of this study was to determine accurately the correction factor for the loading effect of the thermocouple wires. The loading correction factor was measured to be 1.72 with an uncertainty of +- 5 percent. This value should be used when determining true dose to gold with the standard Hydra calorimeters instead of the value of 1.5 obtained from data on Hydra, since there is a larger uncertainty in the latter value. (auth)

21343 SPECTRA OF PRIMARY X-RAY AND SECONDARY PHOTONS FROM SHIELDING MATERIALS FOR 4-30 MV X-RAYS. Maruyama, T.; Sakata, S.; Kumamoto, Y.; Hasizume, T.; Hattori, H.; Kanamori, H.; Yamamoto, M. (National Inst. of Radiological Sciences, Chiba, Japan). Health Phys.; 28: No. 6, 777-791 (Jun 1975).

The spectra of primary x-rays and secondary photons from shielding materials (lead, iron, heavy concrete, ordinary concrete and water) have been studied experimentally over the megavoltage region 4 to 30 MV, using NaI(Tl) scintillation spectrometers, from the point of view of radiation protection against a medical betatron. Spectral measurements were made of both photons transmitted through and scattered from the shielding materials. The measured pulse-height distributions were converted to photon spectra, using inverse response matrices of the crystals. Resultant spectra are tabulated in the unit of the relative photon number per unit energy interval. The average energy of primary and secondary photons has been calculated from the spectrum. Spectra experimentally determined are compared with theoretically calculated spectra. (auth)

21344 TRACK LENGTH DISTRIBUTION IN HELICAL BODIES AND CORRESPONDING DOSE DISTRIBUTIONS. Kiviniitty, K.; Holmberg, P. (Oulu Univ., Finland). Health Phys.; 28: No. 6, 808-809(Jun 1975).

An experimental method used previously by Holmberg et al to determine the track length distribution in cavities (the example of a cylindrical shaped body in a simulated isotropic radiation field was used) is here extended to include more random shaped cavities. The possibilities of the method applied to a helix shaped body are demonstrated. The absorption of 364 keV γ-rays was measured and the corresponding track length deduced. Some 15,000 measurements at different positions of a plastic phantom were obtained. The deduced experimental track length distribution and the dose distribution as a function of LET are shown. (UK)

21345 ENERGY DISTRIBUTION MEASUREMENT OF TRANSMITTED ELECTRONS AND MONTE CARLO SIMULATION FOR KILOVOLT ELECTRONS. Shimuzu, R.; Kataoka, Y.; Matsukawa, T.; Ikuta, T.; Murata, K.; Hashimoto, H. (Osaka Univ., Japan). J. Phys., D (London); 8: No. 7, 820-828(11 May 1975).

Energy distributions of kilovolt electrons transmitted through thin films of aluminium were measured with a spherical gridmesh retarding analyser mounted in a commercial-type electron probe

microanalyser JXA-3. Some modifications to the Monte Carlo calculation based on continuous slowing down approximations have been made to obtain a more realistic model for electron penetration and energy loss. These calculations are compared with experimental measurements of the total energy distribution of 15 keV electrons transmitted through aluminium films of various thicknesses. Analysis and experiment are in satisfactory agreement. (auth)

21346 VALIDITY OF AN EQUIVALENT POINT SOURCE (EPS) ASSUMPTION USED IN QUANTITATIVE SCANNING. Jones, J. P. (Vanderbilt Univ., Nashville); Brill, A. B.; Johnston, R. E. Phys. Med. Biol.; 20: No. 3, 455-464(May 1975).

Most methods used to estimate the absolute organ content of a gamma-emitting radionuclide from external counting measurements assume that the depth distribution of activity is equivalent to a point source of the same activity located at an "effective" depth. A theoretical analysis is presented which shows that this assumption is not correct for a dual opposed detector system, because of self-attenuation of the photons by the organ (or source). Experimental verification is also given, and it indicated that the error caused by this assumption was normally less than 10%, although it could be very large in special cases. (auth)

21347 STOPPING POWER OF ORGANIC COMPOUNDS FOR ALPHA PARTICLES IN THE RANGE 1.5-8 MeV. Burgess, V. W. E. (City Univ., London). J. Phys., D (London); 8: No. 7, 782-789(11 May 1975).

Range-energy relationships for 8.78 MeV α particles in polystyrene, polypropylene and ethyl cellulose have been determined. The stopping powers of CH and CH_2 groups are compared in the solid, liquid and vapour phases and significant differences are noted. The experimental results are also compared with theoretical results. The differences indicate that the mechanism of charge-changing in different phases is incompletely understood. (auth)

21348 DOSE DISTRIBUTIONS AND MEAN DOSES IN CYLINDRICAL CAVITIES OF BONE MARROW ON X-RAY IRRADIATION. Sundararaman, V.; Prasad, M. A. (Bhabha Atomic Research Centre, Bombay (India). Radiological Protection Div.). Strahlentherapie; 149: No. 2, 176-180(1975).

3 figs.; 1 tab.; 14 refs.

Dose distributions as well as mean doses to cylindrical cavities of bone marrow on X-ray irradiation have been calculated using (a) Monte Carlo method and (b) a simplified straight line approximation method. The results are compared with earlier published ones. Point doses differ appreciably from the earlier results by as much as 40% at some points, whereas mean doses agree to within 10% for all the three methods. (auth)

21349 DEPENDENCE OF ALBEDO ON POLARIZATION OF FAST NEUTRONS ARISING DURING SCATTERING BY THE NUCLEI OF A REFLECTOR. Van'kov, A. A.; Voropaev, A. I.; Tsibulya, A. M. Sov. At. Energy (Engl. Transl.); 37: No. 2, 872-874(Aug 1974).

Translated from At. Energ.; 37: No. 2, 168-170(Aug 1974).

Estimates are made of the effect of polarization on the albedo and on the reactivity under the assumptions: (1) the reflector is a pure scatterer in the form of a cylinder of arbitrary radius but small thickness in comparison with the mean free path; neutrons are incident on the reflector along the cylindrical axis; (2) the results of processes of single and double elastic scattering are considered. 2 figs, 8 refs. (GHT)

21350 EXPERIMENTAL AND CALCULATED DOSE DISTRIBUTION IN WATER AROUND CDC K-TYPE CAESIUM-137 SOURCES. Diffey, B. L. (Kent and Canterbury Hospital, Canterbury, Eng.); Klevenhagen, S. C. Phys. Med. Biol.; 20: No. 3, 446-454(May 1975).

The radiation distribution in water around caesium-137 K-type sources has been measured and the experimental results used to provide data for an expression for dose calculations which may be conveniently applied in computer programs. The calculated absorbed dose rate obtained in this manner was estimated to be within 3% of the actual dose rate for any point in water up to 8 cm from the source. It is also suggested that the strength of a brachytherapy source be expressed in terms of an experimental exposure rate at some well-defined distance since this quantity may be determined more precisely and with less ambiguity than source activity. (auth)

21351 THE INFLUENCE OF BLOCK FILTERS ON THE CROSS DOSE DISTRIBUTION IN STANDING FIELD RADIOTHERAPY WITH COBALT-60. Kerber, W. U. Goettingen, Ger.; Univ. Goettingen (1973). 62p. (In German). INIS.

Thesis.

Dose measurements were done with a cobalt-60-teleirradiation device with different blockfilters using a plexiglas water phantom. Cross distributions were measured in different phantom depths at lateral distances of 0.5 cm. It is shown, that the blockfilter influence can be described within the geometrical field boundary as a negative dose field. (GE)

21352 EXPERIMENTAL INVESTIGATIONS ON THE DOSE DISTRIBUTION FROM HIGH ENERGY ELECTRON IRRADIATION USING A 42-MeV-BETATRON WITH WEDGE FILTERS. Zuschlag, J. M. Heidelberg; Univ. Heidelberg (1974). 38p. (In German). INIS.

Thesis.

The isodose curves of fast high-energy electron beams were determined using wedge filters. In the test series, harmonic wedge filters of 20°, 30° and 45° were used. Like the phantom used, they consisted of polystyrol, a synthetic material having a specific density close to 1 and thus greatly resembling the conditions in the human body. It was found that a wedge influences the dose distribution particularly in the lower energy regions. The isodose slope is more strongly flattened compared to irradiation without a wedge. The sideward scattering of the electrons is reduced in all irradiations with wedge and hardly goes beyond the geometrical field boundary. The average electron range is decreased due to the weakening in the wedge by about 15 to 35% depending on the electron energy and wedge angle. (GE)

21353 ATTENUATION OF X-RADIATION IN TISSUE-EQUIVALENT MATERIALS INCLUDING TABLES OF THE RAD/R CONVERSION FACTOR AS A FUNCTION OF RADIATION ENERGY AND GEOMETRICAL IRRADIATION CONDITION. Koren, K. J. Munich; Technische Univ. (1972). 65p. (In German). INIS.

Thesis.

The report covers the subject of measurements of the attenuation of X-rays in various media by means of ionization chambers. The studies were carried out in phantoms with two spherical ionization chambers each of the same physical dimensions, but with different response characteristics to different radiation qualities. The changes found in the ratio between chamber readings are due to changes of the radiation quality as a function of the quality of the incident beam of radiation, the size of field selected, and the depth at which the measurements were carried out in the phantom. Moreover, an attempt is made to draw conclusions from the measurement of the deterioration of the radiation quality in relation to the magnitude of the radiation dose in the bone. In the usual approach, the values measured in the object in Roentgen units are multiplied by a certain conversion factor f so as to allow the dose absorbed in the organ to be expressed in units of rads. The ICRU has indicated this rad/R factor as a function of the photon energy of the radiation. It also published a curve representing the relation between the conversion factor f and the half-value layer. According to the critical evaluation carried out in this study, that curve will have to be modified. Detailed tables have been compiled on the basis of the modified curve. The conversion factor required for calculation of the bone doses can be taken from these tables directly if the ion dose at the point of measurement and the exposure parameters are known. (GE)

21354 THE MODIFYING PARAMETERS OF FAST ELECTRON DOSE DISTRIBUTION WITH HIGH INITIAL ENERGIES. Benedetti, G. R. Wuerzburg, Ger.; Univ. Wuerzburg (1973). 89p. (In German). INIS.

Thesis.

The influence of distinct parameters on the depth dose is analyzed with the following results: 1) At 44 MeV mean energy the field area loses its influence on the depth dose curve. 2) The mean energy losses by production of bremsstrahlung are proportional to the third power of electron energy. 3) Intermediate maxima and minima become smaller with increasing electron energy. (GE)

21355 ALBEDO AND COMPOSITION OF ABSORBED ENERGY FOR A TISSUE-EQUIVALENT SLAB IRRADIATED BY NEUTRONS. Dubinin, A. A.; Obaturov, G. M.; Rykov, V. A.; Shalin, V. A. Sov. At. Energy (Engl. Transl.); 37: No. 5, 1192-1194(Nov 1974).

Translated from At. Energ. (USSR); 37: No. 5, 429-431(Nov. 1974).

Flux and current albedos, neutron capture probability, and fraction of neutron kinetic energy absorbed in the slab are shown as a function of neutron energy for normal and isotropic incidence from thermal energy to 10 MeV. Absorbed energies and fractions of various components in the total absorbed energy are shown for various sources (e.g., capture gamma radiation, protons from $^{14}N(n,p)^{14}C$ reactions, incident neutrons). (3 figures) (RWR)

21356 CALCULATION OF ABSORBED GAMMA DOSE FROM A PLANE SOURCE WITH ARBITRARY ANGULAR AND ENERGY DISTRIBUTIONS. Lazarev, Yu. N.; Chernukhin, Yu. I. Sov. At. Energy (Engl. Transl.); 37: No. 5, 1176-1178(Nov 1974).

Translated from At. Energ. (USSR); 37: No. 5, 419-421(Nov. 1974).

A semianalytical method for calculating the absorbed dose at distances greater than 10 mean free paths from a plane gamma source with arbitrary angular and energy distributions is described. This quantity can be found rather easily if an exact solution is known for the dose from a point monodirectional monochromatic source (PMMS). Absorbed doses from a PMMS and from a plane anisotropic source in water are tabulated for several methods of calculation. It is concluded that the dose from a plane source can be determined relatively simply and reliably by the method described. (2 tables) (RWR)

21357 CALCULATIONS OF ESCAPE PROBABILITIES OF NUCLEAR RADIATIONS FROM SIMPLIFIED MODEL SOURCES. Mori, C. (Nagoya Univ. (Japan). Faculty of Engineering). Radioisotopes (Tokyo); 23: No. 12, 681-685(Dec 1974).

Escape probabilities of radiations from slab and spherical homogeneous sources covered with shields are calculated for three different absorption characteristics of radiations; step functionally decreasing absorption characteristic, linearly decreasing one and exponentially decreasing one. When the probabilities are not expressed in elementary functions, numerically calculated results are given in figures. (auth)

21358 MULTIPLE SCATTERING OF PROTONS AND NITROGEN IONS ON METAL FOILS. Yamazaki, T. (Electrotechnical Lab., Tanashi, Tokyo (Japan). Tanashi Branch); Takasaki, M.; Sakisaka, M. J. Phys. Soc. Jap.; 36: No. 6, 1643-1648(Jun 1974).

The angular distributions are obtained of multiply scattered particles for various impact energies (0.4 ~ 1.5 MeV for protons and 1.3 ~ 4.5 MeV for nitrogen ions), foils (aluminium, copper, silver and gold) and their thicknesses. The data agree fairly well with theories of Molière and of Keil, Zeitler and Zinn with the use of Thomas–Fermi radius which takes account of both projectile and target atom. The slight deviations found when the mean number of scatterings in the foil is smaller than about 20 are attributed to an underestimation of Molière's single-scattering cross section in the small angle region. The theory of Nigam, Sundaresan and Wu shows a large discrepancy from the observations, and that of Meyer also gives a little deviation when the mean number of scatterings is smaller than about 10. (auth)

21359 SIMULATION ON MULTIPLE SCATTERING OF CHARGED PARTICLES USING MONTE CARLO METHOD. Yamazaki, T.; Takasaki, M.; Kashioka, S.; Sakisaka, M. (Electrotechnical Lab., Tanashi, Tokyo (Japan). Tanashi Branch). J. Phys. Soc. Jap.; 37: No. 2, 454-459(Aug 1974).

Multiple scattering of MeV protons and nitrogen ions on amorphous foils has been studied by simulation using Monte Carlo method, where Molière's single-scattering theory is used as a basis. The cases of different mean numbers of scatterings ($4 < \Omega_0 < 64$), with and without energy loss process, and with three geometries of slit are simulated. The calculated angular distributions, the histograms of number of scatterings and an energy spectrum are presented. They agree fairly well with those predicted by theories of Molière and of Keil, Zeitler and Zinn when the theories are applicable, and seem to be reasonable even when analytical treatment is very difficult. (auth)

21360 COMPARISON OF CALCULATIONAL METHODS FOR STRAGGLING IN THIN ABSORBERS. Bichsel, H.; Saxon, R. P. (Univ. of Washington, Seattle). Phys. Rev., A.; 11: No. 4, 1286-1296(Apr 1975).

The solution of the transport equation by the Laplace-transform method, introduced by Landau and modified by Vavilov and others, is compared with the solution of that equation by what we term a convolution method. An energy-loss cross section determined for solid aluminum has been used as input to the calculations. For very small values of absorber thickness, the straggling distribution is dominated to peaks at multiples of the Al plasmon frequency. At intermediate values, these peaks are a small structure superimposed on a broad energy-loss distribution which is not described well by any of the Laplace-transform theories. At larger values, the straggling distribution consists of one peak which is well described by the Vavilov theory. (4 figures, 1 table) (auth)

21361 MONTE CARLO CALCULATIONS OF SCATTERED X-RAYS FROM SNYDER PHANTOMS. Koblinger, L. (Kozponti Fizikai Kuntato Intezet, Budapest). Health Phys.; 28: No. 6, 751-754(Jun 1975).

Monte Carlo calculations are performed to determine the intensity of diagnostic x-rays scattered at 90° from human phantoms. The x-ray source is placed at 90 cm from the centre of the body while the phantom to detector distance is 1 m. Both the homogeneous and inhomogeneous Snyder phantoms are irradiated by an x-ray tube operated at 110 kVp with 3 mm Al filtration. The field size is 14 in. × 17 in. (35.6 cm × 43.2 cm). The ratio of the exposures of the scattered and primary beams is about 3×10^{-3}. The shapes of the spectra of the primary and scattered photons are similar to each other; only the very low and high energy photons are missing from the scattered beam. The calculated results are compared with published measured data. (auth)

21362 ACOUSTICAL PROTON PEAK IN FOILS OF SOLIDS. Borshkovskii, I. A.; Volovik, V. D.; Lazurik-El'tsufin, V. T. Zh. Prikl. Mekh. Tekh. Fiz.; No. 2, 138-140(1975). (In Russian).

The low-frequency component of the acoustical pulse arising in thin foils of solids during interaction with a dense proton beam was studied. Good agreement was obtained between experiment and theory on the region of the maximum of the acoustical signal. (tr-auth)

21363 CALCULATION OF CHARGED PARTICLE FLUENCE AND LET SPECTRA FOR THE IRRADIATION OF BIOLOGICALLY SIGNIFICANT MATERIALS BY NEUTRONS. Edwards, A. A.; Dennis, J. A. (National Radiological Protection Board, Harwell, Eng.). Phys. Med. Biol.; 20: No. 3, 395-409(May 1975).

As a preliminary step to evaluating recent theories concerning the biological effect of ionizing radiation, the charged particle fluence distributions and the dose distribution in linear energy transfer have been computed analytically for targets of biological and dosimetric interest irradiated by neutrons. Specifically, 14.7 MeV neutrons, the ^{252}Cf neutron spectrum and a cyclotron generated neutron spectrum were considered to irradiate water, tissue-equivalent plastic and standard man tissue and results are given for all these cases. From a knowledge of the target composition and the cross-sections and kinetics of all the possibie neutron induced reactions in the elements hydrogen, carbon, nitrogen and oxygen, the secondary particle spectrum was calculated. By combining with stopping power data for the ions in the target, the charged particle fluence spectra and dose distribution in linear energy transfer were derived. Secondary quantities computed were kerma, energy expended as nuclear elastic scattering, specific ionization and mean quality factor. Stopping powers have been derived from published atomic stopping powers by summing according to the Bragg rule. A comparison between tissue-equivalent plastic and standard man tissue has been made for each of the neutron spectra. (auth)

21364 TRANSMISSION IN CONCRETE AND SCATTER ANGULAR DISTRIBUTION OF 25-MV X-RAYS FROM A BETATRON AND A LINEAR ACCELERATOR. De Almeida, C. E.; Rosanky, S. L.; Marbach, J. R.; Almond, P. R. (Univ. of Texas, Houston). Health Phys.; 28: No. 6, 771-775(Jun 1975).

In the past few years, there has been a considerable increase in the use of high energy accelerators in radiotherapy. One of the problems encountered in room design for housing such accelerators is the lack of information in the literature about shielding parameters in the energy range above 10 MeV. In this study, the 25-MV x-rays from an Allis–Chalmers Betatron and a Thompson-CSF Sagittaire Linear Accelerator were studied comparatively. Unreinforced concrete slabs (2.26 g/cm^3) and a modified cutie pie chamber in a water tank connected to a Keithley electrometer were used. Transmission of the primary beams (narrow and broad beam geometries), transmission of secondary radiation at different angles from an Alderson Phantom, variation of 10th-value-layer with field size, scatter angular distribution, and neutron transmission in concrete are presented. (auth)

Radiation Protection Standards

Refer also to abstract 21353.

21365 (KFK-2155) ANNUAL REPORT OF THE RADIATION PROTECTION AND SAFETY DEPARTMENT, 1974. Kiefer, H.; Koelzer, W. (eds.). (Kernforschungszentrum Karlsruhe (F. R. Germany). Abt. Strahlenschutz und Sicherheit). May 1975. 157p. (In German). Dep. NTIS (US Sales Only) $11.00.

Radiation protection and safety in the conventional and nuclear fields at the Karlsruhe Nuclear Research Center are duties of the Radiation Protection and Safety Department. This report informs about the different duties, lists the results of routine measurements of 1974, and covers recent results of investigations and developments in the Working Groups of the Department. (auth)

21366 RADIATION PROTECTION CONTROL OF X-RAY EQUIPMENT FOR MEDICAL PRACTICE. Drexler, G. (Gesellschaft fuer Strahlen- und Umweltforschung m. b. H., Neuherberg/Muenchen (F. R. Germany). Inst. fuer Strahlenschutz). Arbeitsschutz (Cologne).; No. 10, 276-282(Oct 1974). (In German).

33 refs.

Important parameters of the acceptance test under Sec. 4 para. 1 of the German X-Ray Ordinance (RoeV) are briefly explained. Extended inspections by the expert designated by the state author-

ities are discussed: 1) conditions for an extended inspection to be carried out; 2) results of previous tests; and 3) objects of extended inspection-3a) test for spurious radiation on the housing of the tube and the diaphragm system, especially with the primary beam covered, 3b) measurements of the useful beam, 3c) verification of switching times during picture taking, and 3d) check of the image receiver. (GE)

21367 RECORDING OBLIGATION AND RECORDS. Leppin, W. (Albertinenkrankenhaus, Hamburg (F. R. Germany). Strahlenabteilung). pp vp of Information on X-ray Regulations. Braun, H.; Kossel, F.; Ladner, H. A.; Messerschmidt, O.; Stieve, F. E. (eds.). Stuttgart, F. R. Germany; Thieme (1974). (In German).

From 14th annual reunion of the Vereinigung Deutscher Strahlenschutzaerzte e.V.; Wuerzburg, F. R. Germany (16 Nov 1973). 6 figs.; 2 tabs.; 7 refs.

The text of paragraph 29 of the German X-ray Ordinance contains some points of vagueness which make its practical application uncertain. The Bundesgesundheitsamt has now appointed a commission to discuss regulations for the practical application within the frame of the ordinance text. Some results of these discussions are presented. (GE)

21368 LICENSING, REGISTERING, RECORDING ACCORDING TO THE X-RAY ORDINANCE. Stieve, F. E. (Bundesgesundheitsamt, Berlin (F. R. Germany). Abt. fuer Strahlenhygiene). Arbeitsschutz (Cologne).; No. 10, 269-275(Oct 1974). (In German).

3 tabs.; 15 refs.

The measures listed in the German X-Ray Ordinance (RoeV) under the respective purposes of protection for observation of the radiation protection rules are described in detail in a review article: (1) plant operation requiring licenses; (2) indicators showing when certain operational safety criteria are met in design and installation; (3) checks about which records shall be kept by the operator to prove his correct and expert action. (GE)

21369 PROBLEMS OF THE HEALTH PHYSICS SURVEILLANCE WITH SPECIAL REGARD TO MEASURED DATA OF THE STATE INSTITUTE FOR OCCUPATIONAL MEDICINE AT BERLIN. Klesse, R. Berlin; Freie Univ. (1972). 108p. (In German). INIS.

Thesis.

On the basis of an evaluation of 12,846 radiation protection examinations carried out by means of electronic data processing an overview is given of the composition of the group of persons examinsd, who were occupationally exposed persons under the provisions of the First German Radiation Protection Ordinance. The factors used for classification included age, length of occupation with the radiating object, family status, nationality, type of plant, position in plant, work place. In addition, striking data of the anamnesis and the findings of the first examination were compared with those of subsequent examinations and evaluated in terms of their relation to subsequent assessments with respect to the suitability for radiation work. The percentage fraction of work restrictions and bans is very low for a high percentage of "striking" symptoms. Some indications about groups exposed to special hazards can be found from a breakdown of the group of persons who had made no/or wrong statements about their periods of employment and their work places. It is remarkable that the percentage of pregnancies is particularly high in this category. The list of references is an attempt to present an overview of the most important research topics in the field of radiation protection and its "ancillary sciences." (GE)

Radiation Source Calibration and Standardization

Refer also to abstracts 19815, 21065, 21094, 21211, 21212, and 21350.

21370 COMPARISON OF EXPOSURE STANDARDS FOR ^{60}Co GAMMA RAYS. Niatel, M. T. (Bureau International des Poids et Mesures, 92 - Sevres (France)); Loftus, T. P. (National Bureau of Standards, Washington, D. C. (USA)); Oetzmann, W. (Physikalisch-Technische Bundesanstalt, Braunchweig (F. R. Germany)). Metrologia.; 11: No. 1, 17-23(Mar 1975).

1 fig.; 10 tabs.; 21 refs.

Comparisons for ^{60}Co gamma rays between the exposure standards of the Bureau International des Poids et Mesures (BIPM), the National Bureau of Standards (NBS) and the Physikalisch-Technische Bundesanstalt (PTB) are reported. For measurements made at about one meter from the source, and if the same physical constants are used, the differences are 0.26% between the BIPM and NBS standards, and at most 0.4% between the BIPM standard and the PTB standard chambers. The differences are consistent with the estimated systematic uncertainties (approximately 0.5%). The difference between the NBS standard and the PTB chamber measurements, as determined through the ratios of each to the BIPM chamber, ranges from 0.17 to 0.66%. The difference in exposure standards for NBS and PTB actually ranges from 0.48 to 0.97%, since different stopping power corrections are used by these two laboratories. An indirect comparison of the BIPM and NBS standards indicates that the difference of 0.26% will increase to 0.55% at a distance of two meters. (auth)

21371 RADIATION OF A SPHERICAL SELF-ABSORBING SOURCE. Korzhov, L. N. Sov. At. Energy (Engl. Transl.); 37: No. 2, 870-871(Aug 1974).

Translated from At. Energ.; 37: No. 2, 167-168(Aug 1974).

Analytical expressions are presented for calculating the radiation field generated by a spherical source taking account of self-absorption. 2 figs (GHT)

21372 NEUTRON SPECTRUM OF A ^{244}Cm–Be SOURCE BY THE RECOIL PROTONS METHOD AND DETERMINATION OF THE AVERAGE ENERGY E_n. Capgras, A.; Ronteix, C.; Sueur, M. (CEN de Saclay, Gif-sur-Yvette, France). Int. J. Appl. Radiat. Isot.; 26: No. 5, 261-265(May 1975). (In French).

The neutron spectrum of a ^{244}Cm-Be source is determined by means of an organic liquid scintillator spectrometer. A short description of the experimental procedure is given, and the spectrum is compared with the Am-Be and the Pu-Be spectra. The average energy is $E_n = 3.70 \pm 0.15$ MeV but is a function of the Cm isotopic composition. (auth)

Shielding Calculations and Experiments

Refer also to abstracts 21075, 21265, and 21338.

21373 CALCULATION OF NEUTRON ENERGY SPECTRUM AND NEUTRON FLUX IN THE VICINITY OF WATER SHIELDS. Doerschel, B. (Univ., Dresden). Kernenergie; 18: No. 3, 76-82 (1975). (In German).

The changes in the energy spectrum of neutrons due to water shields of various thicknesses arranged in neutron fields were calculated by using the Monte Carlo method. 14-MeV neutrons, pile neutrons, and thermal neutrons were chosen as the primaries. The spectra of the transmitted and reflected neutrons are characterized by spectral parameters which are given as a function of shield thickness. The flux fractions of thermal, intermediate, and fast neutrons in the total flux of the primary, transmitted and reflected neutrons are discussed. From the results obtained conclusions are drawn with respect to neutron dosimetry. (8 figures) (auth)

PHYSICS (THEORETICAL)

21374 ELECTRODYNAMICS OF TACHYONS. Lemke, H. (Sktion Physik, Freiberg i. B.). Nuovo Cim., 27A: No. 2, 141-154(21 May 1975).

Electrodynamic properties of processes involving charged tachyons are considered in connection with the real superluminal Lorentz transformations. These transformations are interpreted without making use of a tachon corridor and so that the interaction of tachyons from subluminal sources with ordinary matter is Lorentz invariant. Transformations of the electromagnetic fields are deduced from the extended principle of relativity. They are necessary in order to obtain the field equations that are satisfied by fields obeying Maxwell equations relative to superluminal inertial frames with respect to subluminal inertial frames. The field equations allow one to get the dependence of the field energy density and its current on the field strengths. The resulting equations are applied in a discussion of plane electromagnetic waves, sent out by a superluminal source. The obtained electrodynamics allows the existence of charged tachyons for a long time and predicts that faster-than-light electric charges do not behave as magnetic monopoles. At last the possibility of Čerenkov radiation, induced by tachyons in subluminal media, is explained. (auth)

General

Refer also to abstracts 21016, 21024, and 21407.

21375 (CNRS-CPT-74-P-611) UNBOUNDED DERIVATIONS OF C* ALGEBRAS. Bratteli, O.; Robinson, D. W. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). Dec 1974. 20p. INIS.

Unbounded derivations of C* algebras are studied and those which generate one-parameter groups of automorphisms are characterized. A functional calculus for the domains of closed derivations and criteria for closeability are developed. Some special C* algebras are considered and in this last context the existence of non-closeable derivations is proved. (FR)

21376 (CNRS-CPT-75-P-694) THE CENTER OF APPROXIMATELY FINITE-DIMENSIONAL C*-ALGEBRAS. Bratteli, O. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). Jan 1975. 10p. INIS.

It is proved that any separable Abelian C*-algebra with unit is the center of an approximately finite-dimensional C*-algebra. (FR)

21377 (INIS-mf-1729) LORENTZ INVARIANCE AND THE β-ALGEBRA OF RELATIVISTIC WAVE EQUATIONS DESCRIBING MASSIVE PARTICLES WITH A GIVEN SPIN. Saavedra, I. (Chile Univ., Santiago. Departamento de Fisica). 1972. 93-108p. INIS.

From 4th Brazilian symposium on theoretical physics; Rio de Janeiro, Brazil (4 Jan 1972).

The purpose here is twofold: first, to spell out explicitly the connection between the Lorentz invariance of general (i.e., for arbitrary spin) relativistic wave equations and the angular momentum operator J, and second, to discuss some of the applications of the resulting formalism. It is proved that the requirement of Lorentz invariance imposed on the general wave equation leads naturally to the requirement that a certain operator used here be the angular momentum operator. Examples are given to illustrate the construction of the β-algebra. (INIS)

21378 (JINR-E2-8632) REMARKS ABOUT SINGULAR SOLUTIONS TO THE DIRAC EQUATION. Uhlir, M. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 23p. Dep. NTIS (US Sales Only) $4.25.

The singular solutions of the Dirac equation are investigated. They are constructed, in the Lorentz-covariant way, of functions proportional to the static multipole functions of scalar and/or electromagnetic fields and of regular solutions of the Dirac equation. The regularization procedure excluding divergences of total energy, momentum, and angular momentum of the considered spinor field is presented. (auth)

21379 (JINR-E4-8818) RIGOROUS STATEMENT ABOUT SYSTEMS INTERACTING WITH BOSON FIELD. Zagrebnov, V. A.; Brankov, I. G.; Tonchev, N. S. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 11p. Dep. NTIS (US Sales Only) $4.00.

A system containing a finite-mode boson field coupled with N-particles is investigated. A sketch is given of the proof that such a system, under some general assumptions, is thermodynamically equivalent to one without interaction between the subsystems. (auth)

21380 (JINR-R-7866) ON THE DIMENSIONAL PROPERTIES OF THE HAMILTONIAN DENSITY. Dao Vong Dyk. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 12p. (In Russian). INIS.

The behavior of the components of the energy-momentum tensor during scale transformation is examined. The dimensional property of the Hamiltonian density is discussed. It is shown that, if part of the Hamiltonian density, responding to a disturbance of the scale transformation, has a dimension of 3, then the dimension of any operator F(x) (if the dimension can be determined for this operator) for which $< n(0) \mid F \mid \pi(0) > \neq 0$ or $< N(0) \mid F \mid N(0) > \neq 0$ is also equal to 3. (tr-auth)

21381 (ORO-3992-217) STRUCTURE OF BARNACLED RELATIVISTIC WAVE EQUATIONS. Khalil, M. A. K. (Texas Univ., Austin (USA). Center for Particle Theory). 31 Jul 1975. 44p. Dep. NTIS $5.25.

Manifestly Lorentz covariant wave equations of the form (beta/sup mu/delta/sub mu/ + im) psi(x) equals 0 are considered. It is shown that there are classes of such equations that reduce to simpler wave equations, derived from the original equation, in the free case. A subclass of these equations with reducible (beta/sub mu) are called barnacled wave equations. Barnacled wave equations maintain their equivalence to the simpler equations in all interactions that are coupled through beta/sub mu/ or its powers; as for example in a minimally coupled external electromagnetic field. Alternatively these equations introduce a new freedom in writing covariant wave equations that describe the same free physical system (and the same interacting system if interactions are coupled through the beta/sub mu/). The structural properties of barnacled wave equations are considered in several contexts: a theorem is proven that allows both for the construction of all possible barnacled wave equations covariant under a given respresentation of SL(2,l), as well as determining whether or not a given equation can be brought to a barnacled form. It is shown that under certain conditions once a representation of SL(2,l) is specified, all equations covariant under the given representation must necessarily be barnacled. A complete classification scheme for barnacled wave equations is constructed. The necessary and sufficient conditions for a nonsingular Hermitizing matrix, eta, to exist for these wave equations are also found. Some formalism is also advanced, which makes it convenient to study general wave equations. (auth)

21382 (ORO-3992-226) REGULAR PERTURBATIONS IN A VECTOR SPACE WITH INDEFINITE METRIC. Chiang, C. C. (Texas Univ., Austin (USA). Center for Particle Theory). Aug 1975. Contract AT(40-1)-3992. 18p. Dep. NTIS $4.00.

The Klein space is discussed in connection with practical applications. Some lemmas are presented which are to be used for the discussion of regular self-adjoint operators. The criteria for the regularity of perturbed operators are given. (JFP)

21383 SEPARATING TOPOLOGY FOR LORENTZ GROUP L. Vroegindeweij, P. G. (Technological Univ., Eindhoven, Netherlands). J. Math. Phys. (N.Y.); 16: No. 6, 1210-1213(Jun 1975).

Some properties of the Lorentz group L are presented if it is endowed with a topology induced by one of the topologies for the Minkowski space M, proposed by E. C. Zeeman. (auth)

21384 IDEAL, FIRST-KIND MEASUREMENTS IN A PROPOSITION-STATE STRUCTURE. Cassinelli, G.; Beltrametti, E. G. (Istituto Nazionale di Fisica Nucleare, Genoa (Italy). Istituto di Scienze Fisiche). Commun. Math. Phys.; 40: No. 1, 7-13(1975).

12 refs.

Let L be an orthomodular lattice and S a strongly ordering set of probability measures on L such that supports of measures exist in L. Then we show the existence of a set of mappings of S into S that are physically interpretable as ideal, first-kind measurements. (auth)

21385 CONFORMAL GROUPS AND CONFORMALLY EQUIVALENT ISOMETRY GROUPS. Defrise-Carter, L. (Girton Coll., Cambridge (UK)). Commun. Math. Phys.; 40: No. 3, 273-282(Mar 1975).

13 refs.

It is shown that if an n dimensional Riemannian or pseudo-Riemannian manifold admits a proper conformal scalar, every (local) conformal group is conformally isometric, and that if it admits a proper conformal gradient every (local) conformal group is conformally homothetic. In the Riemannian case there is always a conformal scalar unless the metric is conformally Euclidean. (GE)

21386 ON THE NON-RELATIVISTIC LIMIT OF THE DIRAC THEORY. Hunziker, W. (Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Theoretische Physik). Commun. Math. Phys.; 40: No. 3, 215-222(Mar 1975).

7 refs.

The relation between a "nonrelativistic" Hamiltonian of the form $H = (A+B)^2 + C$ and a corresponding family of "Dirac-Hamiltonians" H(c) in the limit $c \to$ infinity is investigated. It is shown that the resolvent $(z - H(c))^{-1}$ and the relativistic perturbation of isolated eigenvalues of H are analytic in $1/c$ for sufficiently large absolute c. (GE)

21387 IMPROVED CRITERIA FOR HYPERBOLIC-ELLIPTIC MOTION IN THE GENERAL THREE-BODY PROBLEM. II. Yoshida, J. (Kyoto Sangyo Univ. (Japan). Dept. of Physics). Publ. Astron. Soc. Jap.; 26: No. 3, 367-377(Sep 1974).

In addition to the previous criteria (Yoshida 1972) for the hyperbolic-elliptic motion in the general three-body problem, another one is given by taking into account the non-zero angular momentum. So long as the conditions regarding the angular momentum of the system are satisfied, the new criterion includes theorem 1 in Yoshida (1972). The effect of the new criterion is different in each case as illustrated in Becker's (1920) numerical examples, having a negative total energy. In disregard of the rigorous estimations of numerical errors, these examples are shown to be hyperbolic-elliptic as $t \to +\infty$, and thus contradict Chazy's (1929) assertion that there are no motions of the exchange type in the three-body problem. (auth)

21388 HAMILTONIAN DYNAMICS AND THE SCHROEDINGER EQUATION. Bess, L. (Rutgers-the State Univ., New Brunswick, N. J. (USA). Dept. of Physics). Progr. Theor. Phys. (Kyoto); 52: No. 1, 313-328(Jul 1974).

It is shown that the Schrödinger equation can be derived by a variation on the Hamiltonian methods of classical physics which feature the action function S. This variation consists mainly in treating an ensemble of particles instead of a single one. Moreover, the ensemble probability fluid must move in accordance with the laws of a special diffusion process. From the viewpoint adopted here, quantum mechanics is compared with classical mechanics, where the probability fluid of an ensemble is seen to move as a nonviscous laminar flow process. (auth)

21389 RELATIVISTIC BOUND STATE UNDER THE HOOKE-TYPE ACTION-AT-A-DISTANCE. Takabayashi, T. (Nagoya Univ. (Japan). Dept. of Physics). Progr. Theor. Phys. (Kyoto); 52: No. 4, 1376-1391(Oct 1974).

The classical relativistic mechanics of a system consisting of two point particles bound by the Hooke-like action-at-a-distance is established. Relativistic invariance of this interaction is ensured by the prescription that it works between "conjugate" points on the world lines of the two particles, which perform relativistic rigid motion. The conservation laws of 4-momentum and angular momentum are given, and they lead to a linear relation between spin and squared mass of the bound system. Solutions to the fundamental equations of theory are explicitly obtained. Also it is shown that in the non-relativistic limit the theory approaches the usual Hooke-type theory. Quantization of this theory leads to a bilocal wave equation associated with two subsidiary conditions, and this is suitable for the representation of mesonic states lying on a Regge trajectory. Extension to the case where N point particles are mutually bound by the same mechanism is allowed only if $N \leq 3$, and the $N = 3$ case corresponds to baryons. (auth)

21390 METHODS OF EQUIVALENT LOCAL POTENTIAL CONSTRUCTION. Coz, M. (Kentucky Univ., Lexington (USA). Dept. of Physics and Astronomy). Progr. Theor. Phys. (Kyoto); 51: No. 6, 1783-1792(Jun 1974).

The bases for the equivalent local potential (ELP) construction are discussed. A previously published method, which provided a means of obtaining unique local equivalents to non-local potentials, is compared with more recently published extensions which produce a variety of ELP's. Only the first method gives a local Green function which is the exact transform of the non-local Green function. As a consequence one can reformulate the first method by requiring a relation between the two corresponding Green functions. Such a reformulation is absent from the above-mentioned extensions. (auth)

21391 SUPPRESSION OF RUNAWAY EFFECT IN CLASSICAL STOCHASTIC ELECTRODYNAMICS. Theimer, O.; Peterson, P. R. (New Mexico State Univ., Las Cruces). Lett. Nuovo Cim.; 13: No. 8, 279-282(21 Jun 1975).

It was previously suggested that the statistical mechanics of blackbody radiation is modified by the ground state in such a manner that Planck's spectrum can be obtained from the principles of classical statistical physics. While the hypothetical classical ground state radiation is mostly invoked for explaining quantum phenomena in a classical manner, it may have a useful function also in the classical electron theory. One such possibility is presented for the twofold reason of supporting the concept of the classical radiation ground state and of removing some difficulties from the classical electron theory. One of these difficulties is the runaway effect. Since this effect is suppressed by external forces one may expect that the fluctuating electromagnetic field of the ground state radiation may have the same effect. This expectation is shown to be justified. (JFP)

Quantum Field Theories

Refer also to abstracts 20969, 21008, 21421, and 21427.

21392 (COO-2130-163, pp 272-304)) QUANTUM ELECTRODYNAMIC EFFECTS FOR LIGHT AND HEAVY NUCLEI. 1973.

In heavy ion lecture series, 1972-73, Volume II.

The autoionization of positrons and the problem of vacuum polarization are discussed within the framework of quantum field theory. Various possible heavy ion experiments to check on the nonlinearity of electrodynamics are described. (8 figures) (SDF)

21393 (COO-2271-50) POSSIBLE NEW FORM OF MATTER AT HIGH DENSITY. Lee, T. D. (Columbia Univ., New York (USA)). 1974. 23p. (CONF-741164-1). Dep. NTIS $4.25.

From nucleon workshop; Bear Mountain, New York, USA (30 Nov 1974).

Investigation of the structure of the vacuum suggests the possibilities of vacuum excitation states, abnormal nuclear states and a new form of matter at high density. A mathematical presentation of vacuum excitation states and abnormal nuclear states is given. A discussion of the production and detection of the abnormal nuclear state is included. Future study should involve the distribution of high energy or high nucleon density over a relatively large volume to investigate some "bulk" phenomena. (BJG)

21394 (HU-TFT-74-24) PARTIAL DIAGONALIZATION OF BETHE–SALPETER TYPE EQUATIONS. Cronstroem, C. (Helsinki Univ. (Finland). Research Inst. for Theoretical Physics). 1974. 98p. Dep. NTIS (US Sales Only) $8.00.

An equation of the Bethe–Salpeter type is considered, with arbitrary potential and kernel for space-like momentum transfer. The invariance group of the equation is then the Lorenz-group in three dimensions, the O(1,2) group. The standard procedure for the diagonalization of such equations (valid for square integrable solutions only) is generalized to include the case of power-bounded solutions, by means of a generalized O(1,2) expansion formalism. The result is a two-dimensional integral equation for the O(1,2) expansion coefficients. The right-most l-plane singularities of these determine the asymptotic behavior of the amplitudes as in ordinary Regge theory. The formalism can be applied to other dynamical equations possessing O(1,2) symmetry. (auth)

21395 (IC-73-190) THE RENORMALIZATION GROUP AND ITS RELATIVITY PRINCIPLE. Jouvet, B. (International Centre for Theoretical Physics, Trieste (Italy)). Dec 1973. 37p. INIS.

21 refs., 5 figs. Published also in Nuovo Cim., A (1 Oct 1974) v. 23(3) p. 521-549.

After making the distinction between the renormalization operation and the renormalizability property of certain theories in canonical and noncanonical formulations of field theory, the question is raised of how to determine what mathematical structure governs the way the observables depend on the coupling constants. It is shown that the possibility of applying the renormalization group operation to nonperturbative propagators implies the existence of the property of α invertibility that cannot be recognized in perturbation theory and whose consequences are indicated. This property is illustrated by giving an explicit example which, though superrenormalizable in perturbation, is not consistently renormalizable. It is argued that the only justification of the renormalization group, which is always true but may be fallacious in perturbation theory, lies in a physical principle of relativity for the coupling constants. (INIS)

21396 (IC-74-96) THE SPINOR SUPERFIELD AND BOSE–FERMI SYMMETRY. Adjei, S. A.; Akyeampong, D. A. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1974. 11p. INIS.

By using the superspace techniques of Salam and Strathdee, a new super-symmetric Lagrangian involving Dirac and Duffin–Kemmer component fields is obtained. A simple interaction Lagrangian of this spinor superfield with the scalar superfield is studied in perturbation theory, where it is shown that, although

the Lagrangian is not renormalizable at the 1-loop level, remarkable cancellations of divergences occur, leaving only logarithmic and quadratic infinities. (INIS)

21397 (JINR-E2-8796) CONSEQUENCE OF CAUSALITY CONDITION IN FIELD THEORY WITH MOMENTUM SPACE OF CONSTANT CURVATURE. Volobuev, I. P. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 19p. Dep. NTIS (US Sales Only) $4.00.

The field theory with the momentum space of the constant curvature was considered. It is shown that as a consequence of the generalized causality condition by N. N. Bogolubov is the existence, in such a theory, of the integral representation for the scalar field commutator—an analog of the Jost-Lehmann-Dyson representation. (auth)

21398 (JINR-E2-8838) POSSIBLE CONCEPTUAL DIFFICULTIES OF QUANTUM FIELD THEORIES INVOLVING GRAVITATION. Markov, M. A. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 20p. Dep. NTIS (US Sales Only) $4.00.

Theses are presented on the basis of which one should conclude that the gravitational radius of the test body can put principal restrictions on the measurability of coordinates and time in quantum theory; there appear bounds of the type $\Delta \times \Delta T \geq (\hbar\kappa/c^4)$, or, rather, $\Delta r_g \Delta T \geq (\hbar\kappa/c)$, as a consequence of the relation $\Delta E \Delta T \geq \hbar$. The corresponding bounds arise for the measurability of the mean electrostatic field, $\Delta\bar{\Sigma}\Delta T \geq (\hbar\sqrt{\kappa}/r_g^2 c)$, and of the gravitational field (the Christoffel symbols are represented by $\left\{{\alpha \atop \mu\nu}\right\}$), $\Delta\left\{{i \atop j}\right\} \cdot \Delta T \geq (\hbar\kappa/r_g^2 c)$. Thus, the conceptual contradiction arises between the modern concept of the space–time continuum, which serves as the basis of modern field theories, and the real physical properties of the space–time continuum in small regions. (auth)

21399 (JINR-E2-8892) SOLUTION OF THE CHARGE QUANTIZATION PROBLEM. Kadyshevskii, V. G.; Mateev, M. D.; Mir-Kasimov, R. M. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 11p. Dep. NTIS (US Sales Only) $4.00.

Quantum field theory is considered, in which the virtual four-momentum space has De Sitter geometry with curvature defined by the fundamental length l_0. The limit $l_0 \to 0$ corresponds to the usual local theory with Minkowsky p-space. Based on the invariance under local gauge transformation the interaction with the scalar component ϕ of the electromagnetic field is introduced. It is shown that the quantity ϕ in the new scheme is necessarily an angular variable: $|\phi| \leq \frac{kc}{e^2}\pi$. This fact can explain the observed integrality of the particle electric charges. (auth)

21400 (JINR-P2-8877) SCALE TRANSFORMATIONS AND FUNDAMENTAL LENGTH. Kadyshevskii, V. G.; Mateev, M. D.; Mir-Kasimov, R. M. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 15p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Properties of the scale transformations in a quantum field theory with fundamental length are investigated. On the basis of generalized dimensional analysis predictions for the total cross section and the inclusive distribution function are obtained in the ultrahigh energy region. (auth)

21401 (ORO-3992-223) EXACT MAGNETIC MONOPOLE SOLUTIONS IN YANG–MILLS' AND UNIFIED GAUGE THEORIES. Hsu, J. P. (Texas Univ., Austin (USA). Center for Particle Theory). 1975. 17p. Dep. NTIS $4.00.

Magnetic monopoles are studied in non-Abelian gauge theories. The exact static spherically symmetric solutions of the magnetic monopoles in both Yang–Mills' and unified gauge theories are obtained. The energy E of the static system is calculable and it is either zero or infinite. The existence of the magnetic monopole solution is a consequence of symmetry rather than dynamics. A new definition of the electromagnetic field tensor is proposed which relates the static solution of gauge fields and the magnetic monopole solution. Experimental implications are discussed. (auth)

21402 (ORO-3992-224) VIOLATION OF UNITARITY IN A FINITE QUANTUM ELECTRODYNAMICS. Hsu, J. P.; Mac, E. (Texas Univ., Austin (USA). Center for Particle Theory). Aug 1975. 8p. Dep. NTIS $4.00.

By explicit calculations, we show the violation of unitarity in a recently proposed theory of finite quantum electrodynamics on the basis of a limiting procedure. The failure can be traced back to the mathematical non-existence of the limit upon which the theory is built. (auth)

21403 VIOLATION OF RENORMALIZATION GROUP IN A SOLVABLE MODEL. Coullet, P.; Tirapegui, E. (Univ., Nice). Lett. Nuovo Cim.; 13: No. 3, 107-112(17 May 1975).

It is proven that it is not possible to extend the renormalization group representations for $g_0 > g_{0c}$ (although the model has a solution for all real values of g_0) and that this implies that the kernel functions of the renormalization group representations develop singularities which are a direct consequence of the violation of invertibility. (JFP)

21404 SOLITARY-WAVE SOLUTION FOR THE YANG-MILLS FIELD. Ishida, J.; Hosoya, A. (Osaka Univ., Toyonaka, Japan). Lett. Nuovo Cim.; 13: No. 6, 237-239(7 Jun 1975).

A solitary-wave solution is presented for the SU(2) Yang-Mills field in the absence of other interaction fields. The solution has the modified form of the plane wave and is shown to be an elliptic function. In a sense the solution exhibits massive vector mesons. The degree of freedom of the solution is only three. (JFP)

21405 SOME MATHEMATICAL METHODS OF QUANTUM FIELD THEORY. Kuleshov, S. P.; Matveev, V. A.; Sissakian, A. N.; Smondyrev, M. A. (Joint Inst. for Nuclear Research, Dubna, USSR). Phys. Fenn.; 9: No. 3, 141-150(Oct 1974).

Some mathematical realizations of the straightline path concept at high energies are presented. Use is made of methods of functional integration and operator formalism which make it possible to provide a consistent account of the deflection of the particle paths from linear trajectories. (auth)

21406 QUATERNIONIC FORM OF SUPERLUMINAL LORENTZ TRANSFORMATIONS. Mignani, R. (Univ., Rome). Lett. Nuovo Cim.; 13: No. 4, 134-138(24 May 1975).

The connection between the extended theory of relativity and quaternions is exploited by giving the explicit form of superluminal Lorentz transformations in quaternion space. (JFP)

21407 MINIMAL COUPLING AND COMPLEX LINE BUNDLES. Greub, W. (Univ. of Toronto); Petry, H. R. J. Math. Phys. (N. Y.); 16: No. 6, 1347-1351(Jun 1975).

The concept of minimal coupling, which leads to the Schroedinger equation of a particle in an external electromagnetic field, is reformulated within the theory of complex line bundles. The possible generalizations are discussed, and the case of the magnetic monopole is investigated with the help of the new formalism. (auth)

21408 SELF-INTERACTING, BOSON, QUANTUM FIELD THEORY, AND THE THERMODYNAMIC LIMIT IN d DIMENSIONS. Baker, G. A. Jr. (Brookhaven National Lab., Upton, NY). J. Math. Phys. (N. Y.); 16: No. 6, 1324-1346(Jun 1975).

By use of a finite volume, lattice approximation, an approximation to the analytic continuation of a polynomial, self-interacting boson quantum field theory from Minkowski space to Euclidean space was set up. The infinite volume limit for various boundary conditions is shown to exist and to be asymptotic to the perturbation expansion in the coupling constant g at g equals 0. For g: phi^4: d theory mass renormalizability is proved and it is shown how, by use of Nelson's reconstruction theorem, the corresponding Minkowski space quantum field theory can be obtained. It is discussed, at least for d greater than or equal to 4, how statistical mechanical techniques, used to analyze the Ising model in the critical region just above the critical temperature, can be used to compute the properties of quantum field theory. (auth)

21409 DESCENDING PROBLEM IN GREEN'S FUNCTION APPROACH TO QUANTUM FIELD THEORY. Yoshimura, (King's Coll., London (UK). Dept. of Mathematics). Commun. Math. Phys.; 40: No. 3, 259-272(Mar 1975).

1 fig.; 19 refs.

The question how to determine lower many-point functions in terms of higher ones, which we call the descending problem, is discussed for the $(\Phi^4)1 + 3$ model of quantum field theory. Equations to be considered are non-linear non-compact operator equations in complex Banach spaces. Several sufficient sets of conditions for convergence of successive approximation schemes are presented for small values of the renormalised coupling constant. Local uniqueness of solution is proved under certain conditions. (GE)

21410 SOME SIMPLE SOLUTIONS FOR A CLASSICAL FIELD WITH NEGATIVE MASS SQUARED. Calucci, G. (Univ., Trieste, Italy). Lett. Nuovo Cim.; 13: No. 5, 173-175(31 May 1975).

One of the prototypes of the nonlinear field theories where abnormal vacua can appear, leading thus to situations that cannot be attained perturbatively starting from the normal vacuum, is the theory of a real scalar field which is shown formally as negative mass squared and is self-coupled. One-dimensional solutions of the Lagrangian density equation are sought. (JFP)

21411 WIGHTMAN SUPERFIELDS AND THE REALIZATION OF GRASSMANN GENERATORS θ_α. Kotecky, R. (Karlova Univ., Prague). Lett. Nuovo Cim.; 13: No. 7, 269-272(14 Jun 1975).

The superfield can be understood as an element of the Grassmann algebra. The quantized superfields can be described in

the Wightman formulation defining the quantized superfield as a mapping ϕ from the algebra $L_{4,4}$ into the set of linear operators on the Hilbert space. It is shown that one can have a nontrivial relaxation as soon as one equips the Hilbert space with an indefinite metric given by an indefinite sesquilinear form. This is shown by constructing a simple example of a nontrivial realization of Grassmann generators by 4×4 matrices (operators on four-dimensional Hilbert space). (JFP)

21412 GAUGE AND CONFORMAL INVARIANT NONLINEAR SPINOR THEORY. Duerr, H. P. (Mak-Planck-Institut fuer Physik und Astrophysik, Munich). Nuovo Cim., 27A: No. 3, 305-345(1 Jun 1975).

A nonlinear spinor theory for a 2-component Weyl spinor field with anomalous dimension $\frac{1}{2}$ is formulated which is invariant under (local) gauge transformations and the full 15-parameter conformal group. In this formulation a first attempt is made to incorporate all recent developments in this context: establishment of gauge invariance without additional vector fields by virtue of bilinear forms of a subcanonical spinor field of dimension $\frac{1}{2}$, construction of a canonical framework for the subcanonical spinor field by introducing subsidiary fields and by a corresponding extension of the unphysical state space, verification of conformal invariance in the enlarged framework. The present theory appears, in a certain sense, as a canonical imbedding of a nonlinear spinor theory of the Heisenberg type. In the present formulation the spinor theory can be approached by conventional approximation methods. The lowest Bethe-Salpeter approximation for boson states yields nondivergent results for masses and coupling constants but requires a mass scale which is introduced by the assumption of a dilatation asymmetric vacuum. The theory can be readily generalized to include higher internal symmetries and in this form may be appropriate for a fundamental theory of elementary particles. (auth)

21413 THEORY OF THE ELECTROMAGNETIC SELF-FORCE ACCORDING TO CONFORMAL SYMMETRY. Ingraham, R. L. (New Mexico State Univ., Las Cruces). Nuovo Cim., 27B: No. 2, 293-304(11 Jun 1975).

Writing a conformal invariant electrodynamics over space–time sphere space, suggested originally by the conformal invariance of the Maxwell theory, leads unambiguously to a mathematically nonsingular theory of the classical self-force. The new degree of freedom λ, geometrically the sphere radius, has the physical meaning of a minimum nonzero time lag in causal signal propagation. The nonsingular self-force, the absence of Coulomb infinities, the finite e.m. mass renormalization are directly due to the presence of λ. Conformal invariance essentially alone fixes the model of a finite particle, which is both ⟨(point)⟩ and ⟨(extended)⟩ at the same time, however ⟨(extended in time)⟩ rather than spatially. Only retarded fields are used, and no approximations are made. In the lowest orders of a perturbation theory in powers of the classical radius, one recovers the Lorentz equation and (with an important difference) the Lorentz-Dirac equation. (auth)

21414 QUALITATIVE STUDY OF THE RENORMALIZATION GROUP EQUATIONS. Ghika, G.; Visinescu, M. (Inst. for Atomic Physics, Bucharest). Nuovo Cim., 27A: No. 2, 183-193(21 May 1975).

The main purpose is to study the renormalization group equations for the effective mass and the effective coupling constant of a renormalizable field theory characterized by a single coupling constant and a single mass. It is shown that the trajectories of the system of differential equations are of the parabolic and/or hyperbolic type. The elliptic and closed trajectories are absent and consequently there are no theories which are ultraviolet and infrared free at the same time. The bifurcation of the critical points is derived varying the space-time dimensions around those of the physical systems. Finally, some remarks are made concerning the Liapunov asymptotic stability for the renormalization group equations in the case of an arbitrary number of masses and coupling constants. (auth)

21415 GAUGE STRUCTURE OF CANONICAL QUANTUM ELECTRODYNAMICS. Yokoyama, K.; Kubo, R. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Progr. Theor. Phys. (Kyoto); 52: No. 1, 290-303(Jul 1974).

Possible gauge structure associated with the q-number gauge transformation generated by a dipole gaugeon field is extensively studied in the framework of canonical quantum electrodynamics. The gauge structure is classified into two types, which will be referred to as Type I and Type II, respectively. A typical gauge structure in Type I is the one presented in a preceding paper. In Type I all possible one-parameter covariant gauges are divided into two gauge families complementary to each other, each of which is invariant with respect to the gauge transformation, while in Type II there does not occur such a division for gauges and a single gauge family covers the whole region for gauges. Circumstances of the gauge shift through renormalization and structure of binary dipole systems consisting of the longitudinal photon and the gaugeon fields are discussed for each of these two types of gauge structure. (auth)

21416 INTEGRABILITY AND REGULARIZATION IN LOCAL FIELD THEORY. Yamamoto, K. (Osaka Univ., Toyonaka (Japan). Coll. of General Education). Progr. Theor. Phys. (Kyoto); 52: No. 1, 304-312(Jul 1974).

In general the interaction Hamiltonian obtained by the canonical formalism does not satisfy the integrability condition of the Tomonaga-Schwinger equation. Because of this fact, the amplitude written down by Feynman rules is not covariant. As a prescription to extract the covariant part, we present a regularization scheme applicable to any kind of local theory. In this scheme, shifts of the integration momenta are allowed. This means that formal manipulations exactly hold for the regularized amplitudes. Then the regularized amplitudes satisfy the formal relations such as the Ward-Takahashi identities. The condition of the appearance of anomaly is given. The connection with the dimensional regularization is also discussed. (auth)

21417 BOUND STATES AND ASYMPTOTIC FIELDS. Kato, Y. (Utsunomiya Univ. (Japan). Faculty of Engineering); Sekine, K. Progr. Theor. Phys. (Kyoto); 52: No. 2, 659-687(Aug 1974).

Scattering theory in the Lee model with a nonlocal, translation-invariant interaction is studied. Under a suitable condition on the interaction kernel, it is proved that the asymptotic fields exist as strong limits of operators for all the physical particles present in the lowest sectors, including the dressed V-particle and the bound state B in the $V\Theta$-$N\Theta\Theta$ sector. The condition used has some connection with the concept of nuclear operator. The commutation relations of these asymptotic fields among themselves, with other fields and with the Hamiltonian are derived. Existence of the bound state B is established for a certain class of Galilei-invariant kernels. (auth)

21418 PERTURBATIVE CONSTRUCTION OF THE SCHWINGER FUNCTIONS STARTING FROM THE STATIC ULTRA-LOCAL APPROXIMATION. Scarpetta, G. (Univ., Salerno, Italy). Lett. Nuovo Cim.; 13: No. 8, 302-304(21 Jun 1975).

It is shown that all the Nakano–Schwinger functions of the complete quantum field theory can be constructed if one takes the static ultra-local approximation as the zeroth-order solution of an iterative procedure in which the kinematical term is treated as a perturbation. (JFP)

21419 MODELS OF RENORMALIZATION. Aharonov, Y. (Tel Aviv Univ., Israel); Banks, T.; Lerner, E. Lett. Nuovo Cim.; 13: No. 8, 305-309(21 Jun 1975).

Because of the inherent complexity of any system in which renormalization effects occur naturally it is very difficult to find a simple model of renormalization that exhibits the essential physics. Some models which do just that are reported. These models are based on a familiar and intuitive physical idea: the virtual cloud picture of renormalization. (JFP)

21420 REMARKS ON THE FULL ASYMPTOTIC EXPANSION OF FEYNMAN PARAMETRIZED INTEGRALS. Cicuta, G. M.; Montaldi, E. (Univ., Milan). Lett. Nuovo Cim.; 13: No. 8, 310-312(21 Jun 1975).

The connection between the Laplace and Mellin-transform approaches for the derivation of the complete asymptotic expansion of the relativistic propagator in the external field after the Feynman parametrization, in the study of the large-mass limit in field theory, is elucidated. At the same time a gap is filled which seems to exist in the mathematical literature. (JFP)

Gravitation and General Relativity

Refer also to abstracts 20728, 20863, 21025, and 21398.

21421 (IC-74-97) REMARKS ON GAUGE THEORIES OF FUNDAMENTAL FORCES. Chela Flores, J. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1974. 14p. INIS.

By clarifying the concepts of strong and weak gravity in a scalar–scalar–tensor theory of gravitation, we have studied an action principle from which we have discussed several theories of weak and (separately) strong gravity. By further appealing to the general principle of gauge invariance, gauge theories of spontaneously broken discrete symmetries can be discussed. Finally, it is found that superheavy gauge bosons are automatically excluded when both gravities are properly understood. (INIS)

21422 (IFA-FR-123-1975) APPLICATION OF THE ARTIFICIAL SATELLITE OF THE EARTH TO DETERMINE THE VELOCITY OF THE GRAVITATIONAL INTERACTION WITHIN NEWTONIAN GRAVITATIONAL FIELDS. Cristea, G. (Institutul de Fizica Atomica, Bucharest (Romania)). Jan 1975. 8p. Dep. NTIS (US Sales Only) $4.00.

In the first part of this paper, additional data are given concerning a gravimeter consisting in a pendulum-laser set proposed in previous paper of the author. This gravimeter could have a sensitivity of 0.1 microgal or even 0.01 microgal in the case of statistical measurements. If a processing by an on-line computer is used, the pendulum-laser can constitute a gravimeter which, used in statistical measurements on a long time interval, could reach a sensitivity of 10^{-12} g. The second part of the paper points out the advantages resulting from doing the experiment of determining the velocity of the gravitational reaction in an artificial satellite of the earth. The main advantage is the very fact that this measurement can be achieved by means of the existent gravimeters. The massive reduction of the time error is due to the increase of the "sinusoid" frequency resulting from the recording being made on the gravimeter set on an artificial satellite turning around the earth in about 90 minutes. (3 figures) (auth)

21423 PERIHELION PRECESSIONS IN SECOND-ORDER LAGRANGIAN TENSOR FIELD THEORIES. Cavalleri, G. (CISE, Milan); Spinelli, G. Lett. Nuovo Cim.; 13: No. 4, 145-148(24 May 1975).

It is shown that if one assumes a constant proper mass in the flat, unobservable unrenormalized space, the second-order Lagrangian tensor field theories of gravitation studied in a preceding paper lead in a static spherically symmetric field to the same results of Einstein's theory (at the second order in the coupling constant). On the other hand if one lets the proper mass depend on the gravitational field the results are different from Einstein's. (JFP)

21424 TOPICS ON SPACE-TIME TOPOLOGY. III. Whiston, G. S. (Univ. of Durham, Eng.). Inst. J. Theor. Phys.; 12: No. 4, 225-240(Mar 1975).

A detailed review of the topological background to the theory of spinor structures on space-times, including proofs of most of the main results, is given. A continuation of the analysis given in a previous paper (Int. J. Theor. Phys.; 11: 285 (1974)) of the cobordism theory of compact, closed, orientable space-time manifolds is also presented. A new cobordism relation is defined: linear spin cobordism and the linear spin cobordism of space-time manifolds calculated. (auth)

21425 BEYOND THE COSMOLOGICAL SINGULARITY. Novello, M.; Rodrigues, M. C. S. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). Lett. Nuovo Cim.; 13: No. 2, 74-76 (10 May 1975).

The observation is made that vacuum quantum fluctuations of the gravitational field introduce in Einstein's Lagrangian additional terms quadratic in the curvature tensors. This result is exploited in the analysis of the cosmological problem. The most interesting feature of the results concerns the peculiar form of the variation of the gravitational constant. The dependence of G on the cosmical time obeys a law of the Gaussian type superposed with a kind of saturation effect that starts at $\eta = 0$. This new effect allows for the existence of a stable Friedmann universe. (JFP)

21426 FLUX MOMENTUM BY GRAVITATIONAL WAVES. Dionysiou, D. D. (Univ. of Athens). Lett. Nuovo Cim.; 13: No. 2, 86-87(10 May 1975).

A general equation is found which gives the transport of momentum of the N-body system by gravitational waves. (JFP)

21427 TWO-PARAMETER STATIC AND FIVE-PARAMETER STATIONARY SOLUTIONS OF THE EINSTEIN-MAXWELL EQUATIONS. Onengut, G.; Serdaroglu, M. (Middle East Technical Univ., Ankara). Nuovo Cim., 27B: No. 2, 213-228(11 Jun 1975).

The solutions of static axially symmetric Einstein-Maxwell equations corresponding to the series of stationary axially symmetric solutions for gravitational fields of spinning masses obtained by Tomimatsu and Sato are considered. This class of two-parameter solutions representing a system with mass and electric or magnetic dipole are extended through Kinnersley's method of generating stationary Einstein-Maxwell fields. It is shown that all the solutions thus extended have the same behavior in the distant region and describe a source with mass, electric charge, magnetic dipole, higher multipoles of all three kinds and angular momentum. (auth)

21428 "COSMOLOGICAL" CONSTANT AND SCALAR GRAVITATIONS. Lord, E. A.; Sinha, K. P.; Sivaram, C. (Indian Inst. of Science, Bangalore). Progr. Theor. Phys. (Kyoto); 52: No. 1, 161-169(Jul 1974).

If a cosmological term is included in the equations of general relativity, the linearized equations can be interpreted as a tensor-scalar theory of finite-range gravitation. The scalar field cannot be transformed away by a gauge transformation (general coordinate transformation) and so must be interpreted as a physically significant degree of freedom. The hypothesis that a massive spin-two meson (mass m_2) satisfies equations identical in form to the equations of general relativity leads to the prediction of a massive spin-zero meson (mass m_0), the ratio of masses being $m_0/m_2 = \sqrt{3}$. (auth)

REACTOR TECHNOLOGY AND REGULATION

21429 (NP-20418, pp 169-177) NUCLEAR POWER PLANT AVAILABILITY: ITS COSTS AND BENEFITS. Garrick, B. J. May 1975.

In program report. Reactor licensing. (Atomic Industrial Forum, Inc., New York (USA)).

The dividends associated with plant availability are discussed. The importance of better systems engineering and improved maintainability for higher availability is emphasized. (JWR)

21430 (NP-20452) ANNUAL REPORT, 1974. (Norges Teknisk-Naturvitenskapelige Forskningsraad, Oslo). 1975. 277p. (In Norwegian). Dep. NTIS (US Sales Only) $17.75.

The programme of Institutt for Atomenergi (IFA) includes work on the safety and reliability of nuclear power plants, process control and instrumentation, fuel management and technology, isotope production and applications, process chemistry and analysis, rad waste treatment, fundamental research in crystallography and education. Activities in these fields in 1974 are described, mainly briefly, but with more detail on the fuel testing programme at the Halden Reactor Project. (NO)

21431 ENVIRONMENT AND ENERGY CONVERSION IN THERMAL POWER PLANTS. Kuenstle, K. (Kraftwerk Union A. G., Erlangen (F. R. Germany). Abt. Anlagentechnik, Vertrieb). Tech. Mitt.; 68: No. 1/2, 49-55(Jan 1975). (In German).

Among other subjects, the paper deals with air pollution by fossil-fuelled power stations and steps taken to reduce air pollution, environmental impact of nuclear power stations and other plants connected with the fuel cycle, problems of reduction of radioactive discharge and storage of radioactive waste, the problem of waste heat and its ecological consequences, opening of new sites, off-shore nuclear power stations, waste treatment plants, and alternative energy sources of the future such as the fast breeders, nuclear fusion, solar energy. (GE)

21432 THE PROSPECTS OF NUCLEAR ENERGY IN THE UNITED KINGDOM. Cavendish-Bentinck, V. F. W. Atom-Inf.; No. 12, 9-14(1974).

2 figs.

A review is given on the history of the British nuclear energy development characterized by gas cooled reactors. The structural changes already achieved in the British nuclear industry are dealt with as well as the future plans favoring heavy water reactors and to seriously examine the possibilities of pressurized-water reactors. Furthermore, a report is given on the efforts made in the fields of breeder and high temperature reactors, as well as on the activities in all fields of fuel cycles within the framework of international cooperation. (GE)

21433 JAHRESBERICHT 1973. (Annual Report 1973). Cologne; Kerntechnischer Ausschuss (1973). 20p. (In German)

1 tab.

A survey of the foundation, tasks, organization, and operation of the KTA is presented. The survey of activity is divided into central points of the first year of operation and not into activities of the subcommittees and other organs of the KTA. (GE)

21434 ANNUAL REPORT AND ACCOUNT OF THE JAPAN ATOMIC ENERGY RESEARCH INSTITUTE, FOR FISCAL 1973. Jap. At. Energy Res. Inst., Annu. Rep. Acc.; No. 1973, 1-32(Mar 1975).

The activities in JAERI, with its five major branches, i.e. Head Office, Tokai Research Establishment, Takasaki Radiation Chemistry Research Establishment and Isotope Center, for the period of April 1973 to March 1974, are described. The chapters are: studies on production system of nuclear energy, safety consideration, research on utilization of radiation and radioisotopes, isotope production and distribution, control of facility operation and safety supervision, research supporting activities, international cooperation, training of technicians, and general managerial work. (JA)

21435 RESEARCH POINT ON NUCLEAR REACTOR HEAT TRANSFER. Lorenzini, E. (Facolta di Ingegneria, Bologna). Termotecnica (Milan); 29: No. 4, 217-229(Apr 1975). (In Italian).

From 29th Congresso Nazionale ATI; Florence, Italy (Sep 1974).

Analytical and experimental research survey is presented relating to heat transfer with various classes of fluids in simple and complicated ducts: with particular accent on heat transfer in gases, heat generating fluids, boiling. In particular, on the boiling survey, advances in theoretical interpretations concerning burnout heat flux are treated. 148 references. (auth)

21436 POINT OF NET VAPOR GENERATION AND VAPOR VOID FRACTION IN SUBCOOLED BOILING. Saha, P.; Zuber, N. (Georgia Inst. of Technology, Atlanta). pp 175-179 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

An analysis is presented directed at predicting the point of net vapor generation and vapor void fraction in subcooled boiling. It is shown that the point of net vapor generation depends upon local conditions--thermal and fluid dynamic. Thus, at low mass flow rates the net vapor generation is determined by thermal conditions, whereas at high mass flow rates the phenomenon is hydrodynamically controlled. Simple criteria are derived which can be used to predict these local conditions for net vapor generation. These criteria are used to determine the vapor void fraction is subcooled boiling. Comparison between the results predicted by this analysis and experimental data presently available shows good agreement for wide range of operating conditions, fluids and geometries. (auth)

Power Reactors, Non-Breeding, BWR-Type

Refer also to abstracts 21464, 21545, 21627, 21628, 21633, 21634, 21660, 21681, 21687, 21688, 21704, and 21738.

21437 (AECC-1(Amend.1)) FLUID BED DRYER AND AEROPEP SOLIDIFICATION SYSTEM. Amendment 1 to Topical Report. (Aerojet Energy Conversion Co., Sacramento, Calif. (USA)). 28 Jul 1975. 73p. Aerojet Energy Conversion Co., Sacramento, CA.

Information is presented on interfaces between the aerojet fluid bed dryer and the liquid radwaste system, plant ventilation system, and radioactive solid waste handling systems for BWR and PWR type reactors. (JWR)

21438 (CE-1) QUALITY ASSURANCE PROGRAM FOR NUCLEAR POWER PLANTS. (Commonwealth Edison Co., Chicago, Ill. (USA)). Jun 1975. vp. Commonwealth Edison Co., Chicago, IL.

Commonwealth Edison's Quality Assurance Program which delineates the mandatory requirements and procedures that must be implemented and enforced in connection with its nuclear generating stations is described. The report is divided into 18 sections, conforming in format to the 18 Criteria listed in Appendix B to 10CFR50. This document presents the Quality Assurance Program to be employed in the design, procurement, construction, modification, maintenance, in-service inspection and operating of safety-related systems, structures and components of the station. The scope of this Report covers the total Quality Assurance Program for the life of Commonwealth Edison Company nuclear generating plants commencing with the LaSalle County Station and for the operation period of Dresden, Quad Cities and Zion plants. (auth)

21439 (GEAP-20615) ESTIMATING THE RELATIVE PROBABILITY OF PIPING SEVERANCE BY FAULT CAUSE. Wilson, S. A. (General Electric Co., San Jose, Calif. (USA)). Sep 1974. Contract AT(04-3)-189. 66p. Dep. NTIS $5.45.

A comprehensive list of fault causes is prepared, and the relative contribution made by each to the probability of severance in reactor primary piping is estimated. Fault causes are identified and related to stress categories. A critical stress diagram is drawn from experimental results. The orientation of maximum value is chosen for each stress category, by type of component and joint. By judgment, a conditioning probability of occurrence of a fault cause to a component is chosen, as well as a conditional frequency distribution of stress values. By judgment, a conditioning probability of occurrence of a crack in a component is chosen, as well as a conditional frequency distribution of crack size values. By judgment, a conditioning probability of nondestructive testing in a component is chosen, as well as a conditional pattern of detection probabilities, by crack size. These probabilities are used to reduce the probability values in the crack size distributions. Relative values for probability of severance are found by first computing the probability that a random value from an actual stress distribution exceeds a random value of critical stress for a crack size, in a manner similar to "strength versus stress" analysis; second, adding the probability of direct severance; and third, appropriately summing, averaging and finding relative values, to make all results comparable. Results are relative to average probability of severance per location, orientation, site and pipe size. Accordingly, they

do not depend on the number of components in a piping system (except that, in the averaging process, "one each" of each permitted location, orientation, site and pipe size is, in effect, assumed). All input is applicable to carbon steel pipe during hot startup testing, prior to nuclear service, except that the critical stress diagram is from tests on carbon steel pipe at room temperature. The effect of this on results, and of extensions to stainless steel and to the nuclear service period, are discussed. Temperature during hot startup testing, and throughout nuclear operation, is assumed to be 550°F. (auth)

21440 (HEDL-TME-75-10) HEAVY SECTION STEEL TECHNOLOGY PROGRAM. Technical Report No. 36. The Irradiated Fracture Toughness of ASTM A533, Grade B, Class 1 Steel Measured with a Four Inch Thick Compact Tension Specimen. Williams, J. A. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Jan 1975. Contract AT(45-1)-2170. 30p. Dep. NTIS $4.00.

The fracture toughness of an ASTM A533-B four inch thick compact tension specimen irradiated to approximately 3.8×10^{19} n/cm^2 (E greater than 1 MeV) at 550°F was determined to be 80 ksi root in. at a test temperature of 200°F. Smaller 0.394 inch thick fracture specimens were tested prior to the large specimen test to aid in establishing the test temperature and to compare the fracture transition of large and small irradiated specimens. The K/sub Ic.394/ toughness transition as measured at 100 ksi root in. was observed at a temperature of 210°F; plate RW and WR orientations were comparable. Fracture toughness behavior of the small specimens closely predicts the large specimen behavior in the transition region. 23 references. (auth)

21441 (NEDO-13407) MARK III CONFIRMATORY TEST PROGRAM: ONE-THIRD SCALE THREE-VENT TESTS (TEST SERIES 5801 THROUGH 5804). Ernst, R. J.; McIntyre, T. R.; Myers, L. L.; Torbeck, J. E. (General Electric Co., San Jose, Calif. (USA). Boiling Water Reactor Systems Dept.). Jun 1975. vp. General Electric Co., San Jose, CA.

Four series of tests were run in support of the Mark III pressure suppression containment concept. The tests were performed at the Pressure Suppression Test Facility consisting of an integrated system of steam generator, drywell, vent system, and suppression pool. The volumetric scale factor used for facility design was nominally 1:130 based on the BWR6/251-series Mark III containment design. The pool and vent system both represented one-third scale mockups of an eight-degree sector of the Mark III containment including a vertical row of three 15⅞-in. (403 mm)-diameter horizontal vents. Test parameters were simulated break size and location, top vent centerline submergence, and wetwell roof opening size. The transient responses of the steam generator, drywell, vent system, suppression pool, and wetwell air space were measured and analyzed for use in formulating and/or confirming the analytical models used for predicting loss-of-coolant accident transients. Results supported previously reported conclusions and indicated the pressure drop through restrictions above the pool to be within the anticipated range during the pool swell transient. 6 references. (auth)

21442 (NEDO-20922) EXPERIENCE WITH BWR FUEL THROUGH SEPTEMBER 1974. Elkins, R. B.; Williamson, H. E. (General Electric Co., San Jose, Calif. (USA). BWR Projects Dept.). Jun 1975. 28p. General Electric Co., San Jose, CA.

This information report provides an updated review of General Electric experience with production and developmental BWR Zircaloy-clad UO_2 fuel rods through September 1974. Overall, GE BWR fuel experience remains successful with approximately 0.76 percent of fuel examined having fuel cladding perforations, the majority of which were caused by hydriding. Feedback on field experience indicates hydriding has been eliminated as an active fuel cladding perforation mechanism in current fuel production. Based on information currently available, the "improved" 7 x 7 and 8 x 8 design changes will substantially improve fuel reliability with respect to pellet-cladding interaction (PCI), the only other cladding perforation mechanism significantly affecting GE fuel performance. No new failure mechanisms are expected in the current 8 x 8 fuel design because the current performance requirements placed on the fuel are generally within the experience of statistically demonstrated fuel capability. 8 references. (auth)

21443 CONTAINMENT BUILDING FOR THE NUCLEAR POWER PLANT GUNDREMMINGEN 2. Meerwald, K.; Fruehauf, H. (Hochtief A. G., Frankfurt am Main (F. R. Germany)). VGB Kraftwerkstech.; 55: No. 3, 200-204(Mar 1975). (In German). 9 figs.

This plant—block A—is now being extended. The new plant KRB II consists of two blocks—B and C. Each block has a 1,300 MW boiling water reactor of the type KWU 72. The reactor buildings are arranged symmetrically under identical boundary conditions. These two boiling water reactors will have the first containment buildings that do not have the familiar spherical shape and are not made from steel. Instead they will have a cylindrical reinforced-concrete or prestressed-concrete containment building. For gastightness, the concrete construction is reinforced by a steel lining. (GE)

21444 SELECTION OF A GIVEN FAMILY OF REACTORS. Palacios Sunico, L. Energ. Nucl. (Madrid); 18: No. 91, 299-303(1974). (In Spanish).

The factors to be considered in the selection of the type of reactor for electricity generation are briefly outlined. The present nuclear programs in the world are heavily based on light water reactors. The selection of the light water reactor to meet Spanish electricity needs is justified on economic bases and on its proven record of reliability. (JSR)

21445 PANEL DISCUSSION: ENGINEERING PROBLEMS IN POWER REACTOR SHIELDING. Locante, J. (Westinghouse Electric Corp.; Madison, PA); Lowder, W. M.; Engholm, B. A.; Kreger, W. E. Nucl. Technol.; 26: No. 4, 496-507(Aug 1975).

21446 RADIOCHEMICAL MANAGEMENT ON REACTOR COOLING SYSTEM. I. Identification of Radionuclides in the Reactor Coolant With the Radiation Statistic Analyzer. Ohtou, Y.; Nakaoka, A.; Kanbe, H.; Koyama, H. (Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Technical Lab. No. 1). Denryoku Chuo Kenkyusho Gijutsu Daiichi Kenkyusho Hokoku.; No. 73031, 1-17(Nov 1973). (In Japanese).

The purpose of this research is the improvement of the reliability of the reactor coolant system management by the analysis of radioactive nuclides in the reactor coolant. The following were carried out in this experiment: (1) the development of the analysis of radioactive nuclides in the reactor coolant with the radiation statistical analyzer, and (2) the identification of radioactive nuclides in the coolant of a BWR-type reactor which has operated for 12,000 EFPH. (auth)

21447 LAGRANGIAN ANALYSIS OF TWO-PHASE HYDRODYNAMIC AND NUCLEAR-COUPLED DENSITY-WAVE OSCILLATIONS. Lahey, R. T. Jr.; Yadigaroglu, G. (General Electric Co., San Jose, CA). pp 225-229 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

The mathematical technique known as the "method of characteristics" has been used to construct an exact, analytical solution to predict the onset of density-wave oscillations in diabatic two-phase systems, such as Boiling Water Nuclear Reactors (BWR's). Specifically, heater wall dynamics, boiling boundary dynamics and nuclear kinetics have been accounted for in this analysis. Emphasis is placed on giving the reader a clear physical understanding of the phenomena of two-phase density-wave oscillations. Explanations are presented in terms of block diagram logic, and phasor representations of the various pressure drop perturbations are given. (auth)

21448 PREDICTION OF BOILING CRISIS CONDITIONS USING A MODIFIED EMPIRICAL SCALING TECHNIQUE. Miles, D. N.; Lawther, K. R. (Australian Atomic Energy Commission, Sydney). pp 255-259 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

The reasons for using flow boiling crisis scaling techniques are discussed and the two basic scaling techniques are described. A modification of the basic empirical scaling technique is proposed which extends the application of this method for round tube geometries to water equivalent pressures other than the single value (6.89 MPa) for which it had been developed, to tube geometries other than those having equal length to diameter ratios, and to model fluids other than Freon-12 (i.e., Freons-21, -114). The scaling accuracy is generally better than +- 10 percent. (auth)

Power Reactors, Non-Breeding, PWR-Type

Refer also to abstracts 21437, 21438, 21440, 21444, 21445, 21448, 21545, 21627, 21633, 21634, 21673, 21674, 21733, and 21740.

21449 (BAW-10083) BABCOCK AND WILCOX MODEL FOR PREDICTING IN-REACTOR DENSIFICATION. Buescher, B. J.; Pegram, J. W. (Babcock and Wilcox Co., Lynchburg, Va. (USA). Nuclear Power Generation Dept.). Jun 1975. 33p. Babcock and Wilcox, Lynchburgh, VA.

The B and W fuel densification model is used to describe the extent and kinetics of in-reactor densification in B and W produc-

tion fuel. The model and approach are qualified against an extensive data base available through B and W's participation in the EEI Fuel Densification Program. Out-of-reactor resintering tests on representative pellets from each batch of fuel are used to provide input parameters to the B and W densification model. The B and W densification model predicts in-reactor densification very accurately for pellets operated at heat rates above 5 kW/ft and with considerable conservation for pellets operated at heat rates less than 5 kW/ft. This model represents a technically rigorous and conservative basis for predicting the extent and kinetics of in-reactor densification. 9 references. (auth)

21450 (CENPD-161) TORC CODE: A COMPUTER CODE FOR DETERMINING THE THERMAL MARGIN OF A REACTOR CORE. (Combustion Engineering, Inc., Windsor, Conn. (USA)). Jul 1975. vp. Combustion Engineering, Inc., Windsor, CT.

The TORC computer code and the method for applying the code to thermal margin analysis of pressurized water reactor cores are described. The code structure, the conservation equations, and the correlations used in TORC are presented. The method for modelling the reactor core with the code is presented in detail. For comparative purposes, a full description is also included of the earlier COSMO/INTHERMIC thermal margin design codes and their method of application to core analysis. Comparisons are given of core thermal margin values calculated by the TORC and COSMO/INTHERMIC codes for a wide range of reactor operating conditions. A code user's guide is provided for preparing input information for the TORC code. 25 references. (auth)

21451 (CENPD-185) CLAD RUPTURE BEHAVIOR: LOCA RUPTURE BEHAVIOR OF 16 x 16 ZIRCALOY CLADDING. Franklin, D. G.; Kneppel, D. S. (Combustion Engineering, Inc., Windsor, Conn. (USA)). May 1975. vp. Combustion Engineering, Inc., Windsor, CT.

In the ECCS evaluation, prediction of the perforation temperature and the amount of circumferential strain as a function of the differential pressure on the cladding during a LOCA transient is required. CE's new System 80 (S 80) cladding has dimensions (0.382" OD x 0.025" wall) and bundle configuration (16 x 16). Therefore, transient burst tests were performed to determine the rupture properties of the new cladding. The results of this testing are reported. Analysis of the S 80 rupture temperatures and strains has shown essentially the same variation about the CE Evaluation Model as does the Evaluation Model data. It is also shown that adding the S 80 data to the data base produces essentially the same regression fit. 10 references. (auth)

21452 (GKSS-74/E/43) REQUIREMENTS ON A LOW-POWER SEAWATER DESALINATION INSTALLATION WITH NUCLEAR ENERGY SUPPLY. Bockhorn, W.; Boie, H.; Motzkau, S.; Petersen, G. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (F. R. Germany)). 1974. 21p. (In German). Dep. NTIS (US Sales Only) $4.25.

In a mutual Krupp-GKSS study, the requirements on a desalination installation in the output region of 10,000 to 75,000 m^3 distillate/day in combination with a reactor as the heat source were studied. In the installation designed under the name MINIPLEX, the available ship reactor concepts of the FDR or EFDR were used as energy sources for the multi-stage flash evaporator. Economic calculations showed that the water costs in a MINIPLEX installation of the size considered are no higher than in conventionally fired plants of comparable size. (tr-auth)

21453 (INIS-mf-1700, pp 37-45) APPLICATION OF HIGH-CAPACITY NUCLEAR POWER PLANTS IN SUPPLYING REMOTE AREAS WITH HEAT. Gundermann, E. 1974. (In Russian).

From nuclear heating and containments; Brno, Czechoslovakia (3 Oct 1973).

In nuclear heating and containment. Supplement. (Ceskoslovenska Komise pro Atomovou Energii, Prague).

The technical feasibility and the economical questions of supplying remote areas with heat from 440 MW pressurized water reactor nuclear power plants are discussed. (INIS)

21454 (NP-20513) QUALITY ASSURANCE MANUAL: OPERATIONS. (Arkansas Power and Light Co., Little Rock (USA)). 12 May 1975. vp. Arkansas Power and Light Co., Little Rock, AR.

21455 (WCAP-8118-A) MEASURED CHARACTERISTICS OF XENON-INDUCED X--Y OSCILLATIONS IN THE H. B. ROBINSON UNIT 2 NUCLEAR POWER PLANT. Frank, F. J.; Felentzer, D. P.; Lee, J. C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Feb 1975. 61p. Westinghouse Electric Corp., Pittsburgh, PA.

An X-Y xenon oscillation test was performed at the H. B. Robinson, Unit No. 2 plant. The results of these measurements, which began with a core average burnup of 1540 MWD/MTU, demonstrated that the core is stable to X-Y oscillations with a stability index of -0.076 hr^{-1}. The X-Y xenon oscillation test was simulated analytically using a two-dimensional diffusion code. The calculated stability index of -0.081 hr^{-1} is in good agreement with the measured value of -0.076 hr^{-1}. 13 references. (auth)

21456 (WCAP-8202-A) EFFECT OF LOCAL HEAT FLUX SPIKES ON DNB IN NON-UNIFORMLY HEATED ROD BUNDLES. Cadek, F. F.; Hill, K. W.; Motley, F. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Feb 1975. 39p. Westinghouse Electric Corp., Pittsburgh, PA.

High pressure water tests were carried out to measure the DNB heat flux using an electrically heated rod bundle in which three adjacent rods had 20 percent heat flux spikes at the axial location where DNB is most likely to occur. This test series was run at the same conditions as those of two earlier test series which had unspiked rods, so that spiked and unspiked runs could be paired and spike effects could thus be isolated. Results are described. 7 references. (auth)

21457 IRRADIATION FACILITY FOR CORROSION EXPERIMENTS UNDER PRESSURIZED WATER REACTOR CONDITIONS. Ahlf, J.; Reymann, A.; Timm, H.; Wilhelm, H. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (F. R. Germany)). Kerntechnik; 17: No. 3, 135-139(Mar 1975). (In German).

6 figs.; 3 refs.

An important consideration, besides the mechanical strength properties of fuel cladding tubes, is the corrosion performance of these materials under the service conditions in the reactor. This depends on the composition and the previous treatment of the material as well as on the water conditions. A ship propulsion reactor is characterised by harder service conditions than a land reactor. The GKSS is therefore particularly interested in investigations of the kind described above and has been conducting for several years corrosion experiments during irradiation. The irradiation facilities required for this purpose have been steadily developed and improved. The facility described can be operated under conditions corresponding to the service conditions in modern pressurized water reactors (150 bar, 340°C). The stipulated water conditions can be kept constant within narrow limits by continuous renewal of the water. (GE)

21458 SHIELDING DESIGN AND ANALYSIS METHODS FOR PRESSURIZED WATER REACTORS. Sapyta, J. J. (Babcock and Wilcox Co., Lynchburg, VA); Simmons, G. L. (Nucl. Technol.; 26: No. 4, 508-515(Aug 1975).

The S/sub n/ discrete ordinates technique is used as a versatile design tool for a number of pressurized water reactor (PWR) shield design problems. This technique has been used for calculation of maximum neutron fluence at the inside wall of a reactor vessel, neutron flux distributions in steam generators, and neutron and gamma-ray distributions at the outer surface of a reactor vessel. For vessel fluence calculations, comparisons of one-dimensional S/sub n/ and removal diffusion techniques with experiment show that the latter technique predicts higher fluences for typical PWR shield configurations. Two-dimensional discrete ordinates techniques are used to determine neutron flux distributions in the energy range from 10 to 15 MeV in a steam generator that will be used for maritime reactor applications. These neutron distributions are used to calculate the source of ^{16}N in the secondary system of the plant. 10 references. (auth)

21459 INFLUENCE OF FUEL MICROSTRUCTURE ON IN-PILE DENSIFICATION. Chubb, W.; Hott, A. C.; Argall, B. M.; Kilp, G. R. (Westinghouse Electric Corp., Pittsburgh). Nucl. Technol.; 26: No. 4, 486-495(Aug 1975).

Data obtained in the course of irradiation and by postirradiation examinations have disclosed that in-pile densification is controlled by the microstructure of the fuel, particularly its pore size distribution and porosity. These factors, in turn, were found to be controlled by fabrication parameters of which the sintering conditions were most important. The background, data, and theory of densification are reviewed. As a consequence, appropriate controls have been placed on fuel density, microstructure, and sintering conditions to reduce in-pile densification to insignificant levels. 19 references. (auth)

21460 920MVA STEAM TURBINE GENERATORS AND 3500kW BRUSHLESS EXCITERS FOR KEPCO'S TAKAHAMA POWER PLANT. Hayami, K.; Amagasa, N. (Mitsubishi Electric Corp., Kobe (Japan). Kobe Works). Mitsubishi Denki Giho; 48: No. 11, 1279-1286(Nov 1974). (In Japanese).

Test results are presented on the 920MVA steam turbine generator, the largest capacity ever built in Japan, and the 3500kW brushless exciter supplied to Kansai Electric Power's Takahama Power Plant. To ensure total reliability of these large machines,

rigorous care was taken in the design stage, and various tests were carried out in the factory. Manufacture of these generators yielded not only basic data for 800 to 900MVA units but also knowledge of value in the manufacture of units of the 1000 to 1200 MVA class. (auth)

21461 NRI PARTICIPATION IN THE PHYSICS RESEARCH ON THE WWER-TYPE REACTORS IN THE FRAMEWORK OF THE INTERNATIONAL TEMPORARY COLLECTIVE OF CMEA. Hron, M.; Bardos, J.; Lelek, V. (Ustav Jaderneho Vyzkumu, Rez, Czech.). Jad. Energ.; 21: No. 5, 162-166(Mar 1975). (In Czech).

The activities of European CMEA countries in the field of the physical research of the WWER-type reactors are described. The main research directions and the themes of theoretical, calculational and experimental works as well as the forms of cooperation are presented. There is given survey information on a share of the Nuclear Research Institute in this cooperation and reached results. 9 references. (auth)

21462 RADIATION CHEMISTRY AND NUCLEAR SAFETY OF NUCLEAR POWER PLANTS. Behavior of Radioiodine. Bartonicek, B.; Habersbergerova, A.; Bednar, J. (Ustav Jaderneho Vyzkumu, Rez, Czech.). Jad. Energ.; 21: No. 5, 176-180(Mar 1975). (In Czech).

The role of radiation chemistry in the investigation of behavior of radioiodine from the point of view of nuclear safety of nuclear power plants is shown. Experimental results on radiation formation of methyl iodide and radiation chemical changes of inorganic forms of iodine in alkaline medium are given. The importance of these findings for the choice of containment sprays is deduced. 12 references. (auth)

21463 ANALYSIS OF THE STATISTICAL ERROR IN A HEAT CONDUCTION CODE CALCULATION. Herborn, D. I. (Aerojet Nuclear Co., Idaho Falls, Idaho). pp 171-173 of Heat Transfer, 1974. Vol. 1. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P1.

The statistical errors in the calculations of a heat conduction program resulting from uncertainties in input variables were evaluated for a pressurized water reactor fuel rod overpower situation. The computed average fuel temperature was 1980 +- 230°K, and the computed cladding surface temperature was 616 +- 4°K. (auth)

Power Reactors, Non-Breeding, Graphite Moderated

Refer also to abstracts 19605, 19606, 19609–19611, 21445, 21545, 21553, 21640, 21641, and 21739.

21464 (AED-CONF-74-673-001) REACTOR CONTAINMENTS MADE OF REINFORCED AND PRESTRESSED CONCRETE FOR NUCLEAR POWER PLANTS. Schnellenbach, G.; Zerna, W.; Stangenberg, F. (Bochum Univ. (F. R. Germany)). 1974. 15p. (In German). INIS.

From VGB-conference: building construction in thermal power plants; Karlsruhe, F. R. Germany (22 Oct 1974).

14 figs.; 1 tab.; 7 refs. With abstract.

Reactor containments are required for all future nuclear power plants in the FRG. While the containments up to present have been made of steel, the nuclear power plants Kalkar, Gundremmingen II and Schmehausen II are in the process of designing or preparing for the first steel concrete or prestressed concrete reactor containments. The brief description of the very different containments of the three nuclear power plants mentioned and the special problematics of the partly extraordinary impacts show that the working-out of a standard guideline for such constructions is urgently needed. The preparations for this have already begun and one can expect a copy of the first draft by the end of 1975. (GE)

21465 (GA-A-13276) PREIRRADIATION REPORT HT-28 AND HT-29. Kovacs, W. J.; Harmon, D. P. (General Atomic Co., San Diego, Calif. (USA)). 13 Jun 1975. Contract AT(04-3)-167. 37p. Dep. NTIS $4.00.

The HT-28 and 29 irradiation capsules are part of a cooperative agreement between GA and ORNL designed to evaluate irradiation performance of unbonded BISO and TRISO coated ThO_2 fertile fuel particles. The capsules will contain a total of 44 different positions uniformly divided between each capsule. The positions in HT-29 are designated for operation at 900°C over a fast fluence increment between 5.4 to 10.7 x 10^{21} n/cm^2 (E greater than 0,18 MeV)/sub HFIR/. Positions in HT-28 are divided into two sections: 11 positions at 1250°C to receive a fast fluence exposure between 7.8 and 8.6 x 10^{21} n/cm^2 (E greater than 0,18 MeV)/sub HFIR/ and 11 positions at 900°C designed for a 4.3 to 6.9 x 10^{21} n/cm^2 (E greater than 0,18 MeV/sub HFIR/ fast fluence exposure. Both capsules are to serve as an evaluation test to characterize the performance of BISO OPyC coatings deposited from mixed-gas (acetylene-propylene). The OPyC variables tested will be density, coating rate, and thickness. A secondary objective of these tests will be to evaluate a TRISO coated ThO_2 design and determine the effect of coating rate and thickness on OPyC failure. (auth)

21466 (GA-A-13319) EVALUATION OF CORROSION: INHIBITING COMPOUNDS FOR THE PROTECTION OF PRESTRESSING SYSTEMS. Hildebrand, J. F. (General Atomic Co., San Diego, Calif. (USA)). 14 Feb 1975. Contract AT(04-3)-633. 6p. (CONF-750906-1). Dep. NTIS $4.00.

From International conference on PCRVs; York, UK (8 Sep 1975).

The materials and methods used to protect the tendons of the Fort St. Vrain PCRV are discussed from the point of wire manufacture, through tendon fabrication and installation, to final protection and closure of the prestressing system. The results of several inspections are presented. (auth)

21467 (GA-A-13383) LEAKTIGHTNESS IN HTGRs: EXPERIENCE AT FORT St. VRAIN. Neylan, A. J.; Barker, R. A.; Deardorff, A. F. (General Atomic Co., San Diego, Calif. (USA)). 10 Jun 1975. Contract AT(04-3)-633. 9p. (CONF-750906-2). Dep. NTIS $4.00.

From International conference on PCRVs; York, UK (8 Sep 1975).

The Fort St. Vrain Prestressed Concrete Reactor Vessel is the first utilized to contain the helium coolant of a High Temperature Gas-Cooled Reactor. Because the helium coolant contains fission products, leakage from the vessel is limited to 15 percent of vessel inventory per year. The fabrication methods and development tests used to assure this leaktightness and the leakage test conducted to verify it are described. (auth)

21468 (GERHTR-108) DETERMINATION OF THE BURNUP, NEUTRON FLUENCE, FISSION PRODUCT CONCENTRATION, AND HEAVY METAL CONCENTRATION IN INDIVIDUAL FUEL ELEMENTS. Litzow, W. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Chemische Technologie). Apr 1974. 63p. (In German). (KFA-ICT-IB-3/74). Dep. NTIS (US Sales Only) $6.25.

Work performed under United States–German High Temperature Reactor Research Exchange Program.

Equations are derived for the calculation of the burn-up in undistorted Th–U fuel elements from the γ line intensities of their fission products, determination of the activity of individual fission products from the γ line intensities in the fission product spectrum, and estimation of the mass of individual heavy metal nuclides from the burn-up. The limitations and capacity of the γ spectrometric installation in burn-up determination and activity determination are evaluated. The γ-active fission product nuclides are tabulated. (JSR)

21469 (GERHTR-130) STATUS AND PURPOSE OF FUEL ELEMENT DEVELOPMENT FOR HIGH TEMPERATURE REACTORS. Balthesen, E. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany)). 10 Jan 1975. 20p. (In German). Dep. NTIS (US Sales Only) $4.00.

Work performed under United States–German High Temperature Reactor Research Exchange Program.

After a brief overview of the three types of fuel elements under current development—spherical fuel elements in the German Federal Republic, the prismatic graphite block element in the USA, and the tubular block-rod or monolithic concept in Great Britain—the development status of coated fuel particles, common to all three fuel element types, is reviewed. A more detailed examination is then made of the development status of each of the three types. (JSR)

21470 GASIFICATION OF COAL BY STEAM-REFORMING WITH THE AID OF NUCLEAR REACTOR HEAT. Krueger, H.; van Heek, K. H.; Juentgen, H. GWF Gas - Erdgas.; 115: No. 12, 538-542(Dec 1974). (In German).

3 figs.; 2 tabs.; 10 refs.

The development state and the aims of coal gasification are reported. The cost structure of the gas economy changes with the application of coal gasification. Also described are: (a) the gasification of coal by steam-reforming using process heat from high-temperature nuclear reactors; (b) the thermal efficiencies of the production of the different synthetic fuels dependent on the helium outlet temperature of the high-temperature nuclear reactors; (c) the layout of a plant for the production of town gas using process heat; and (d) the state of development of the application of nuclear process heat to coal gasification. (GE)

21471 SPATIAL XENON OSCILLATIONS IN HIGH-TEMPERATURE REACTORS. Lauer, A. Aachen; Univ. Aachen (1972). 153p. (In German). INIS.

Thesis.

In the present work, the influence of various core parameters is firstly qualitatively assessed in an introductory chapter. In the second part, a report is given on a newly-developed, expanded programme system to quantitatively, numerically calculate the reactor behaviour under the influence of the xenon reaction. It is suitable for the study of free and regulated xenon oscillations and flux distortions with load change transients which are also of great economical importance due to their influence on the required regular reactivities. The investigation thus carried out on xenon oscillations in high temperature reactors are shown. This deals with a generally held, systematic examination of the stability properties of the various axial, radial and azimuthal modes of oscillation in this type of reactor, their excitation, their course and various continuous and discrete control measures. (GE)

21472 THE DEVELOPMENTAL PROGRESS OF HIGH TEMPERATURE GAS COOLED REACTOR (HTGR) AND ITS FEATURE. Matsumoto, S. (Electric Power Development Co. Ltd., Tokyo (Japan)). Genshiryoku Kogyo; 20: No. 7, 33-37(Jul 1974). (In Japanese).

The developmental progress of high temperature gas cooled reactors (HTGR) and their features are described. The characteristics of HTGRs are operation at high temperature, effective use of generated energy, and possibility of multi-purpose use. Safety of the core is high, and the pressure vessels for HTGRs are made of prestressed concrete and safer than the vessels made of steel. Liquid waste from HTGRs is minimal, and the effect on the environment is very small. It is possible to use various fuel cycles for HTGRs. The cycles considered are thorium combined with highly enriched uranium, thorium combined with plutonium, and slightly enriched uranium. (JA)

21473 CONSTRUCTION AND OPERATION OF A LARGE HIGH TEMPERATURE HELIUM GAS LOOP. Shimomura, H.; Okamoto, Y.; Kawamura, H.; Negoya, S.; Fujimura, S. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). FAPIG (Tokyo); No. 71, 139-149(Nov 1973). (In Japanese).

A large high temperature helium gas loop was constructed and operated to study the condition of reactor cores at 40 kg/cm^2 and 1000°C. Total operation time was 640 hours, and high temperature operation was performed for 320 hours. While the loop was operated at high temperature, the distributions of temperature, flow rate, and pressure were observed. Characteristics of heat exchange, overall heat transfer coefficient, thermal expansion, and heater efficiency were also obtained. The high temperature characteristics of the high temperature components of the loop were in agreement with design values. It was necessary to control the purity of helium, and a purification apparatus was installed in the loop. The concentration of impurities was kept under 1 ppm. The temperature at the high temperature part of the loop was controlled to prevent abnormal rise. Problems seen during the test operation are described. (JA)

Power Reactors, Non-Breeding, Otherwise Moderated

Refer also to abstracts 21490, 21732, and 21736.

21474 (AECL-5106) INTERPRETING FAILURE DATA IN A NUCLEAR PLANT BY THE HAZARD FUNCTION. Wolfe, W. A. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Apr 1975. 42p. (CONF-750416-3). Dep. NTIS (US Sales Only) $5.25. AECL $1.00.

From IAEA symposium on reliability of nuclear power plants; Innsbruck, Austria (14 Apr 1975).

Field Failure Data is often dirty and incomplete. Many items survive the reporting period. The failure rate may be changing because of better operating conditions, better maintenance, or improvements. The Hazard Function as developed by Dr. Wayne Nelson of the General Electric Company provides a useful tool for the interpretation of incomplete data and failure from different causes. Failure data on pump seals for slightly more than three years' experience is examined and interpreted by the Hazard Function. (auth)

21475 (CE-BNL-BIB-5(Rev.1)) CANDU REACTOR SYSTEM: A BIBLIOGRAPHY, 1967–DECEMBER 1974. Hitchings, F. A. (comp.). (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Apr 1975. 19p. Dep. NTIS (US Sales Only) $4.00.

Eighty-six selected references on the CANDU reactor system are presented together with abstracts. The period covered is 1967 to December 1974. References were compiled from CEGB indexes, Nuclear Science Abstracts, and INIS Atomindex. (TIC)

21476 THE DEVELOPMENT OF A FUEL TRANSFER FACILITY FOR PROTOTYPE ATR "FUGEN". Akebi, M.; Honda, S.; Kasai, Y. (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)). Doryokuro Giho; No. 11, 39-51(Jul 1974). (In Japanese).

The fuel transfer facility for the prototype ATR "Fugen" is used to move fuel, sealing plugs, shielding plugs and other components between the fuel-exchange device and fuel storage. It differs from the conventional in that fuel exchange is performed during reactor operation, and a relay pool is located much higher than a storage pool. A transfer facility was constructed, including major components of the specification, to test the performance of a highly inclined transfer chute and the durability of the components in a containment vessel. Concerning the development of the fuel transfer facility, the following matters are described: the fuel transfer facility for Fugen, the prototype fuel transfer facility and tests performed with the facility. (JA)

21477 COMPUTER CONTROL SYSTEM FOR ATR REFUELLING MACHINE MOCK-UP. Yokota, M.; Nakada, Y. (Fuji Electric Co. Ltd., Kawasaki, Kanagawa (Japan). Kawasaki Factory). Fuji Jiho; 47: No. 11, 816-820(Nov 1974).

A computer control system for the refuelling machine for the Advanced Thermal Reactor was planned because of the complex operation involved. Automatic operating tests were conducted using the computer system on a mock-up of the refuelling machine. The construction of the computer control system, the software and operation test results are presented. (auth)

21478 REACTIVITY EXCESS AND FUEL BURN-UP IN THE KS-150 REACTOR. Galanin, A. D.; Il'ichev, B. I.; Kochurov, B. P.; Mikhailov, V. M. (Inst. of Theoretical and Experimental Physics, Moscow). Jad. Energ.; 21: No. 4, 143-151(Apr 1975). (In Russian).

The theoretical value of the effective height of the reactor core H^T_{eff} = 179.4 cm agrees with the experimental value H^E_{eff} = 178 ± 1.5 cm within the accuracy of the critical experiment. The calculated reactivity excess in the hot non-poisoned reactor with fresh fuel is 6.9%. The method for calculation of isotopic changes of the fuel element as well as the reactivity excess are briefly described. The values of constants used are also given. The results obtained by the described method agree well with the experiment in the NRX reactor. The calculated reactivity excess for the reactor control is 2.1% for the design burnup Wt = 2800 MW-days/t. Without the reactivity excess for the reactor control the burnup Wt = 5500 ± 800 MW-days/t can be reached. 27 references. (auth)

21479 PHYSICAL START-UP OF THE A-1 NUCLEAR POWER PLANT REACTOR KS-150. Part II. Results of Experiments Carried Out During the Physical Start-up. Burgov, N. A. (Inst. of Theoretical and Experimental Physics, Moscow); Medzhibovskii, B. A.; Belkin, V. F. Jad. Energ.; 21: No. 4, 126-134(Apr 1975). (In Russian).

Experiments were carried out during the physical start-up of the KS-150 reactor to determine: the moderator level in the cold nonpoisoned reactor; control rod worth; moderator devel coefficient ($\delta\rho/\delta H$); neutron flux distribution along the fuel element, along the reactor radius and height, in the vicinity of the control rod, and close to the channel with the withdrawn fuel element; initial conversion factor and other physical characteristics of the lattice cell; neutron flux inside the reactor shielding; fast neutron flux at the reactor vessel. The control system was checked, special features of its function at the design current values of the ionization chambers and at sudden reactivity steps were found. Basic physical characteristics measured agreed practically with those predicted by the design. 31 references. (auth)

21480 METHOD FOR CALCULATION OF PHYSICAL PARAMETERS OF UNIFORM HEAVY WATER GAS-COOLED REACTOR LATTICES. Galanin, A. D.; Il'ichev, B. I.; Kochurov, B. P.; Mikhailov, V. M.; Burmistrov, A. Ya. (Inst. of Theoretical and Experimental Physics, Moscow). Jad. Energ.; 21: No. 4, 134-143(Apr 1975). (In Russian).

The method for calculation of physical parameters of uniform gas-cooled heavy water reactor lattices including the selected constant system is presented and the computer programs are briefly described. Analytical methods are given for calculation of resonance escape probability corrections connected with the nonuniformity of the slowing-down neutron leakage along the fuel elements and with the non-resonance capture in the fuel elements. Calculated and experimental values of the critical param-

eter (K_{eff}) measured in critical assembly were compared. 33 references. (auth)

21481 PHYSICAL START-UP OF THE A-1 NUCLEAR POWER PLANT REACTOR KS-150. Part I. The Preparation of the Physical Start-Up. Burgov, N. A. (Inst. of Theoretical and Experimental Physics, Moscow); Medzhibovskii, B. A.; Belkin, V. F. Jad. Energ.; 21: No. 4, 122-125(Apr 1975). (In Russian).

The preparation of the start-up of the CO_2-cooled heavy water natural uranium reactor KS-150 of the A-1 nuclear power plant is described. The physical start-up was prepared parallel with final works on technological equipment, montage, and functional tests of different plant systems. Experimental methods to determine all basic physical characteristics of the KS-150 reactor and its control system were checked during this preparation. Elaborate organisatory provisions for the start-up, reliable coordination of the cooperation of physicists — experimenters as well as of the operational staff produced necessary conditions of a successful start-up. 9 references. (auth)

21482 BEHAVIOR OF METALLIC URANIUM AND OTHER FUEL ELEMENT MATERIALS IN REACTORS. Novak, J.; Slancar, F.; Splichal, K. (Ustav Jaderneho Vyzkumu, Rez, Czech.). Jad. Energ.; 21: No. 5, 172-176(Mar 1975). (In Czech).

The results of research, concerned with materials of fuel elements for power station A-1 are discussed. Dimensional changes were studied with model elements, as well as corrosion behaviour of cladding, its structural stability and mechanical properties. The main problems of post-irradiation examination of fuel elements which are connected with swelling, plutonium diffusion and cladding failures are mentioned. 15 references. (auth)

21483 IMPORTANCE OF THE FIRST CZECHOSLOVAK NUCLEAR POWER PLANT FOR THE DEVELOPMENT OF NUCLEAR POWER. Goldschmidt, J. (Ministerstvo Paliy a Energetiky CSSR, Prague). Energetika; No. 7, 273-276(Jul 1974).

New knowledge is surveyed ensuing from the development and the construction of the A-1 nuclear power plant that is of great importance for the Czechoslovak industries in relation to nuclear power and that can be also applied in other fields of the national economy. (INIS)

21484 DENSITY OF STEAM-WATER MIXTURES FLOWING IN 19-ROD CLUSTERS UNDER ADIABATIC AND HEATED CONDITIONS. Agostini, G.; Premoli, A.; Prina, A.; Ravetta, R.; Rubiera, L. (CISE, Milan). Energ. Nucl. (Milan); 22: No. 5, 237-252(May 1975).

The final part is presented of an experimental investigation concerning density of steam-water mixtures flowing in vertical channels under adiabatic and heated conditions. The experiments were performed by using two 19 rod clusters which were full scale models of the CIRENE reactor power channels. Mixture densities were measured by means of the quick-closing valve technique. An analysis of data is reported, which shows to what extent the main governing parameters affect density and slip ratio. Moreover these data are compared with data previously obtained under similar thermodynamic conditions but with different channel configurations. A comparison is then given with the correlation previously developed at CISE for the slip ratio calculation. 14 references. (auth)

Power Reactors, Breeding

Refer also to abstracts 19641, 19647, 19833, 21264, 21265, 21267, 21464, 21543, 21628, 21631, 21632, 21635–21637, 21641–21643, 21645, 21646, 21662, 21665, 21667–21670, 21684, and 21734.

21485 (ANL-CT-75-20) SENSITIVITY PREDICTIONS VIA PARAMETER VARIATION IN THE STEADY STATE AND TRANSIENT COMPUTATIONAL MODELS OF THE ARGONNE SGTF. Sanathanan, C. K.; Dudas, A. J. (Argonne National Lab., Ill. (USA)). Dec 1974. Contract W-31-109-eng-38. 84p. AT.

Predictions pertaining to the thermo-hydraulic performance of the SGTF are presented. The numerical results are obtained by means of computer codes prepared to simulate the mathematical models. (auth)

21486 (ANL-CT-75-44) ADVANCED LMFBR CORE RESTRAINT SYSTEM AND INTERFACING SYSTEMS: TENTATIVE DESIGN CONCEPT AND EVALUATION WORK PLAN. Huebotter, P. R.; Fulford, P. J.; McLennan, G. A. (Argonne National Lab., Ill. (USA)). Jul 1975. Contract W-31-109-eng-38. 26p. AT.

The proposed design eliminates the top load pads (TLPs), converts the above core load pads (ACLPs) to stamped buttons on the ducts, and eliminates the TLP and ACLP core former rings. It uses a long bending-bar-type nozzle with an upper pivot point taking the vertical load and a small diametral clearance at the bottom end. The design anticipates the use of a bottom fission gas plenum with the fuel and blanket ducts above the pin bundle either reduced in diameter or articulated to avoid strong mechanical interactions at the free ends. Control assemblies have conventional ducts (full diameter and nonarticulated) whose top-end positions are governed by nozzle support and their own free-bowing behavior. Advantages and disadvantages of the design are described. 12 references. (auth)

21487 (ANL-CT-76-1) REVIEW OF RECENT DEVELOPMENTS ON CAVITATION IN CENTRIFUGAL PUMPS. Cha, Y. S.; Hammitt, F. G. (Argonne National Lab., Ill. (USA)). Jul 1975. Contract W-31-109-eng-38. 39p. AT.

Recently published literature on cavitation of centrifugal pumps is reviewed. Incipient cavitation, cavitation noise, and cavitation damage are discussed separately. Important scale effects, such as pump speed, flow rate, gas contents, and thermodynamic effects, are also discussed. It is concluded that the conventional 3% head drop-off criterion for cavitation inception is not adequate in guaranteeing pump operation without cavitation damage and noise. Large scale effects, particularly those due to flow rate and speed, exist for all liquids. Thermodynamic scale effects for cavitation inception performance are probably negligible for liquid sodium at temperatures below 1500°F. However, it is probable that damage may decrease considerably by this temperature because of thermodynamic effects. The present state of knowledge does not allow a meaningful prediction of detailed cavitation behavior of a new pump design from past experience. (auth)

21488 (ANL-CT-76-4) FLOW-INDUCED VIBRATION SCALE MODEL TESTS OF CRBR-UIS. Mulcahy, T. M.; Yeh, T. T.; Jendrzejczyk, J. (Argonne National Lab., Ill. (USA)). Jul 19 Contract W-31-109-eng-38. 43p. AT.

A scale model simulating the flow paths of a single Clinch River Breeder Reactor outlet module and the structural dynamics of the upper internal structure's first unengaged vibration mode was tested to determine if the flow from nine simulated fuel assembly nozzles would induce significant model vibrations. Fluidelastic vibration of the model was observed for two typical outlet module flow zones and for many orientations of the outlet module's flow collector with respect to a close packed configuration of nine fuel assembly nozzles. The fluidelastic vibration was characterized by a significant increase in the rate of change of vibration amplitude with increases in flow rate, once a threshold flow rate had been exceeded. (auth)

21489 (CONF-750607-24) STATUS OF THE CLINCH RIVER BREEDER REACTOR PLANT NUCLEAR STEAM SUPPLY SYSTEM. Jacobi, W. M. (Westinghouse Electric Corp., Baltimore, Md. (USA)). [nd]. 6p. Dep. NTIS $4.00.

From American Nuclear Society meeting; New Orleans, Louisiana, USA (8 Jun 1975).

The status of the CRBR project is reviewed. Major accomplishments have been achieved by the Project. Supporting the major milestones, system design descriptions and equipment specifications have been completed by the reactor manufacturers and architect engineer. Major milestone events, such as preparation of the Environmental Report and the Preliminary Safety Analysis Report, have been completed. (auth)

21490 (CONF-750810-1) INVESTIGATION OF TWO-PHASE LIQUID-METAL MAGNETOHYDRODYNAMIC POWER SYSTEMS. Amend, W. E.; Fabris, G.; Cutting, J. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-eng-38. 14p. Dep. NTIS $4.00.

From international seminar on future energy conversion in heat and mass transfer problems; Dubrovnic, Yugoslavia (25 Aug 1975).

A two-phase Liquid-Metal MHD (LMMHD) system is under development at the Argonne National Laboratory, and results are presented for detailed cycle analysis and systems studies, the experimental facility, and the thermal and magneto fluid mechanics problems encountered. The studies indicate that the LMMHD cycle will operate efficiently in the temperature range of 1000-1600°F (50% efficiency with a maximum cycle temperature of 1600°F) and is therefore potentially compatible with many advanced heat sources under development such as the LMFBR, fluidized-bed coal combustor, HTGCR and the fusion reactor. Of special interest is the coupling to the LMFBR thereby eliminating the costly, potentially hazardous liquid-metal/water interface. The results of detailed parametric studies of the heat transfer interfaces between an LMMHD power cycle and an LMFBR and a steam bottoming plant are described. Experimental evaluation of the two-phase LMMHD generator was performed in an ambient temperature NaK-N_2 facility at ANL. Results of these

21471 SPATIAL XENON OSCILLATIONS IN HIGH-TEMPERATURE REACTORS. Lauer, A. Aachen; Univ. Aachen (1972). 153p. (In German). INIS.

Thesis.

In the present work, the influence of various core parameters is firstly qualitatively assessed in an introductory chapter. In the second part, a report is given on a newly-developed, expanded programme system to quantitatively, numerically calculate the reactor behaviour under the influence of the xenon reaction. It is suitable for the study of free and regulated xenon oscillations and flux distortions with load change transients which are also of great economical importance due to their influence on the required regular reactivities. The investigation thus carried out on xenon oscillations in high temperature reactors are shown. This deals with a generally held, systematic examination of the stability properties of the various axial, radial and azimuthal modes of oscillation in this type of reactor, their excitation, their course and various continuous and discrete control measures. (GE)

21472 THE DEVELOPMENTAL PROGRESS OF HIGH TEMPERATURE GAS COOLED REACTOR (HTGR) AND ITS FEATURE. Matsumoto, S. (Electric Power Development Co. Ltd., Tokyo (Japan)). Genshiryoku Kogyo; 20: No. 7, 33-37(Jul 1974). (In Japanese).

The developmental progress of high temperature gas cooled reactors (HTGR) and their features are described. The characteristics of HTGRs are operation at high temperature, effective use of generated energy, and possibility of multi-purpose use. Safety of the core is high, and the pressure vessels for HTGRs are made of prestressed concrete and safer than the vessels made of steel. Liquid waste from HTGRs is minimal, and the effect on the environment is very small. It is possible to use various fuel cycles for HTGRs. The cycles considered are thorium combined with highly enriched uranium, thorium combined with plutonium, and slightly enriched uranium. (JA)

21473 CONSTRUCTION AND OPERATION OF A LARGE HIGH TEMPERATURE HELIUM GAS LOOP. Shimomura, H.; Okamoto, Y.; Kawamura, H.; Negoya, S.; Fujimura, S. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). FAPIG (Tokyo); No. 71, 139-149(Nov 1973). (In Japanese).

A large high temperature helium gas loop was constructed and operated to study the condition of reactor cores at 40 kg/cm^2 and 1000°C. Total operation time was 640 hours, and high temperature operation was performed for 320 hours. While the loop was operated at high temperature, the distributions of temperature, flow rate, and pressure were observed. Characteristics of heat exchange, overall heat transfer coefficient, thermal expansion, and heater efficiency were also obtained. The high temperature characteristics of the high temperature components of the loop were in agreement with design values. It was necessary to control the purity of helium, and a purification apparatus was installed in the loop. The concentration of impurities was kept under 1 ppm. The temperature at the high temperature part of the loop was controlled to prevent abnormal rise. Problems seen during the test operation are described. (JA)

Power Reactors, Non-Breeding, Otherwise Moderated

Refer also to abstracts 21490, 21732, and 21736.

21474 (AECL-5106) INTERPRETING FAILURE DATA IN A NUCLEAR PLANT BY THE HAZARD FUNCTION. Wolfe, W. A. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Apr 1975. 42p. (CONF-750416-3). Dep. NTIS (US Sales Only) $5.25. AECL $1.00.

From IAEA symposium on reliability of nuclear power plants; Innsbruck, Austria (14 Apr 1975).

Field Failure Data is often dirty and incomplete. Many items survive the reporting period. The failure rate may be changing because of better operating conditions, better maintenance, or improvements. The Hazard Function as developed by Dr. Wayne Nelson of the General Electric Company provides a useful tool for the interpretation of incomplete data and failure from different causes. Failure data on pump seals for slightly more than three years' experience is examined and interpreted by the Hazard Function. (auth)

21475 (CE-BNL-BIB-5(Rev.1)) CANDU REACTOR SYSTEM: A BIBLIOGRAPHY, 1967-DECEMBER 1974. Hitchings, F. A. (comp.). (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Apr 1975. 19p. Dep. NTIS (US Sales Only) $4.00.

Eighty-six selected references on the CANDU reactor system are presented together with abstracts. The period covered is 1967 to December 1974. References were compiled from CEGB indexes, Nuclear Science Abstracts, and INIS Atomindex. (TK)

21476 THE DEVELOPMENT OF A FUEL TRANSFER FACILITY FOR PROTOTYPE ATR "FUGEN". Akebi, M.; Honda, S.; Kasai, Y. (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)). Doryokuro Giho; No. 11, 39-51(Jul 1974). (In Japanese).

The fuel transfer facility for the prototype ATR "Fugen" is used to move fuel, sealing plugs, shielding plugs and other components between the fuel-exchange device and fuel storage. It differs from the conventional in that fuel exchange is performed during reactor operation, and a relay pool is located much higher than a storage pool. A transfer facility was constructed, including major components of the specification, to test the performance of a highly inclined transfer chute and the durability of the components in a containment vessel. Concerning the development of the fuel transfer facility, the following matters are described: the fuel transfer facility for Fugen, the prototype fuel transfer facility and tests performed with the facility. (JA)

21477 COMPUTER CONTROL SYSTEM FOR ATR REFUELLING MACHINE MOCK-UP. Yokota, M.; Nakada, Y. (Fuji Electric Co. Ltd., Kawasaki, Kanagawa (Japan). Kawasaki Factory). Fuji Jiho; 47: No. 11, 816-820(Nov 1974).

A computer control system for the refuelling machine for the Advanced Thermal Reactor was planned because of the complex operation involved. Automatic operating tests were conducted using the computer system on a mock-up of the refuelling machine. The construction of the computer control system, the software and operation test results are presented. (auth)

21478 REACTIVITY EXCESS AND FUEL BURN-UP IN THE KS-150 REACTOR. Galanin, A. D.; Il'ichev, B. I.; Kochurov, B. P.; Mikhailov, V. M. (Inst. of Theoretical and Experimental Physics, Moscow). Jad. Energ.; 21: No. 4, 143-151(Apr 1975). (In Russian).

The theoretical value of the effective height of the reactor core H^T_{eff} = 179.4 cm agrees with the experimental value H^E_{eff} = 178 ± 1.5 cm within the accuracy of the critical experiment. The calculated reactivity excess in the hot non-poisoned reactor with fresh fuel is 6.9%. The method for calculation of isotopic changes of the fuel element as well as the reactivity excess are briefly described. The values of constants used are also given. The results obtained by the described method agree well with the experiment in the NRX reactor. The calculated reactivity excess for the reactor control is 2.1% for the design burnup Wt = 2800 MW-days/t. Without the reactivity excess for the reactor control the burnup Wt = 5500 ± 800 MW-days/t can be reached. 27 references. (auth)

21479 PHYSICAL START-UP OF THE A-1 NUCLEAR POWER PLANT REACTOR KS-150. Part II. Results of Experiments Carried Out During the Physical Start-up. Burgov, N. A. (Inst. of Theoretical and Experimental Physics, Moscow); Medzhibovskii, B. A.; Belkin, V. F. Jad. Energ.; 21: No. 4, 126-134(Apr 1975). (In Russian).

Experiments were carried out during the physical start-up of the KS-150 reactor to determine: the moderator level in the cold nonpoisoned reactor; control rod worth; moderator devel coefficient ($\delta\rho/\delta H$); neutron flux distribution along the fuel element, along the reactor radius and height, in the vicinity of the control rod, and close to the channel with the withdrawn fuel element; initial conversion factor and other physical characteristics of the lattice cell; neutron flux inside the reactor shielding; fast neutron flux at the reactor vessel. The control system was checked, special features of its function at the design current values of the ionization chambers and at sudden reactivity steps were found. Basic physical characteristics measured agreed practically with those predicted by the design. 31 references. (auth)

21480 METHOD FOR CALCULATION OF PHYSICAL PARAMETERS OF UNIFORM HEAVY WATER GAS-COOLED REACTOR LATTICES. Galanin, A. D.; Il'ichev, B. I.; Kochurov, B. P.; Mikhailov, V. M.; Burmistrov, A. Ya. (Inst. of Theoretical and Experimental Physics, Moscow). Jad. Energ.; 21: No. 4, 134-143(Apr 1975). (In Russian).

The method for calculation of physical parameters of uniform gas-cooled heavy water reactor lattices including the selected constant system is presented and the computer programs are briefly described. Analytical methods are given for calculation of resonance escape probability corrections connected with the nonuniformity of the slowing-down neutron leakage along the fuel elements and with the non-resonance capture in the fuel elements. Calculated and experimental values of the critical param-

eter (K_{eff}) measured in critical assembly were compared. 33 references. (auth)

21481 PHYSICAL START-UP OF THE A-1 NUCLEAR POWER PLANT REACTOR KS-150. Part I. The Preparation of the Physical Start-Up. Burgov, N. A. (Inst. of Theoretical and Experimental Physics, Moscow); Medzhibovskii, B. A.; Belkin, V. F. Jad. Energ.; 21: No. 4, 122-125(Apr 1975). (In Russian).

The preparation of the start-up of the CO_2-cooled heavy water natural uranium reactor KS-150 of the A-1 nuclear power plant is described. The physical start-up was prepared parallel with final works on technological equipment, montage, and functional tests of different plant systems. Experimental methods to determine all basic physical characteristics of the KS-150 reactor and its control system were checked during this preparation. Elaborate organisatory provisions for the start-up, reliable coordination of the cooperation of physicists — experimenters as well as of the operational staff produced necessary conditions of a successful start-up. 9 references. (auth)

21482 BEHAVIOR OF METALLIC URANIUM AND OTHER FUEL ELEMENT MATERIALS IN REACTORS. Novak, J.; Slancar, F.; Splichal, K. (Ustav Jaderneho Vyzkumu, Rez, Czech.). Jad. Energ.; 21: No. 5, 172-176(Mar 1975). (In Czech).

The results of research, concerned with materials of fuel elements for power station A-1 are discussed. Dimensional changes were studied with model elements, as well as corrosion behaviour of cladding, its structural stability and mechanical properties. The main problems of post-irradiation examination of fuel elements which are connected with swelling, plutonium diffusion and cladding failures are mentioned. 15 references. (auth)

21483 IMPORTANCE OF THE FIRST CZECHOSLOVAK NUCLEAR POWER PLANT FOR THE DEVELOPMENT OF NUCLEAR POWER. Goldschmidt, J. (Ministerstvo Pally a Energetiky CSSR, Prague). Energetika; No. 7, 273-276(Jul 1974).

New knowledge is surveyed ensuing from the development and the construction of the A-1 nuclear power plant that is of great importance for the Czechoslovak industries in relation to nuclear power and that can be also applied in other fields of the national economy. (INIS)

21484 DENSITY OF STEAM-WATER MIXTURES FLOWING IN 19-ROD CLUSTERS UNDER ADIABATIC AND HEATED CONDITIONS. Agostini, G.; Premoli, A.; Prina, A.; Ravetta, R.; Rubiera, L. (CISE, Milan). Energ. Nucl. (Milan); 22: No. 5, 237-252(May 1975).

The final part is presented of an experimental investigation concerning density of steam-water mixtures flowing in vertical channels under adiabatic and heated conditions. The experiments were performed by using two 19 rod clusters which were full scale models of the CIRENE reactor power channels. Mixture densities were measured by means of the quick-closing valve technique. An analysis of data is reported, which shows to what extent the main governing parameters affect density and slip ratio. Moreover these data are compared with data previously obtained under similar thermodynamic conditions but with different channel configurations. A comparison is then given with the correlation previously developed at CISE for the slip ratio calculation. 14 references. (auth)

Power Reactors, Breeding

Refer also to abstracts 19641, 19647, 19833, 21264, 21265, 21267, 21464, 21543, 21628, 21631, 21632, 21635–21637, 21641–21643, 21645, 21646, 21662, 21665, 21667–21670, 21684, and 21734.

21485 (ANL-CT-75-20) SENSITIVITY PREDICTIONS VIA PARAMETER VARIATION IN THE STEADY STATE AND TRANSIENT COMPUTATIONAL MODELS OF THE ARGONNE SGTF. Sanathanan, C. K.; Dudas, A. J. (Argonne National Lab., Ill. (USA)). Dec 1974. Contract W-31-109-eng-38. 84p. AT.

Predictions pertaining to the thermo-hydraulic performance of the SGTF are presented. The numerical results are obtained by means of computer codes prepared to simulate the mathematical models. (auth)

21486 (ANL-CT-75-44) ADVANCED LMFBR CORE RESTRAINT SYSTEM AND INTERFACING SYSTEMS: TENTATIVE DESIGN CONCEPT AND EVALUATION WORK PLAN. Huebotter, P. R.; Fulford, P. J.; McLennan, G. A. (Argonne National Lab., Ill. (USA)). Jul 1975. Contract W-31-109-eng-38. 26p. AT.

The proposed design eliminates the top load pads (TLPs), converts the above core load pads (ACLPs) to stamped buttons on the ducts, and eliminates the TLP and ACLP core former rings. It uses a long bending-bar-type nozzle with an upper pivot point taking the vertical load and a small diametral clearance at the bottom end. The design anticipates the use of a bottom fission gas plenum with the fuel and blanket ducts above the pin bundle either reduced in diameter or articulated to avoid strong mechanical interactions at the free ends. Control assemblies have conventional ducts (full diameter and nonarticulated) whose top-end positions are governed by nozzle support and their own free-bowing behavior. Advantages and disadvantages of the design are described. 12 references. (auth)

21487 (ANL-CT-76-1) REVIEW OF RECENT DEVELOPMENTS ON CAVITATION IN CENTRIFUGAL PUMPS. Cha, Y. S.; Hammitt, F. G. (Argonne National Lab., Ill. (USA)). Jul 1975. Contract W-31-109-eng-38. 39p. AT.

Recently published literature on cavitation of centrifugal pumps is reviewed. Incipient cavitation, cavitation noise, and cavitation damage are discussed separately. Important scale effects, such as pump speed, flow rate, gas contents, and thermodynamic effects, are also discussed. It is concluded that the conventional 3% head drop-off criterion for cavitation inception is not adequate in guaranteeing pump operation without cavitation damage and noise. Large scale effects, particularly those due to flow rate and speed, exist for all liquids. Thermodynamic scale effects for cavitation inception performance are probably negligible for liquid sodium at temperatures below 1500°F. However, it is probable that damage may decrease considerably by this temperature because of thermodynamic effects. The present state of knowledge does not allow a meaningful prediction of detailed cavitation behavior of a new pump design from past experience. (auth)

21488 (ANL-CT-76-4) FLOW-INDUCED VIBRATION SCALE MODEL TESTS OF CRBR-UIS. Mulcahy, T. M.; Yeh, T. T.; Jendrzejczyk, J. (Argonne National Lab., Ill. (USA)). Jul 19 Contract W-31-109-eng-38. 43p. AT.

A scale model simulating the flow paths of a single Clinch River Breeder Reactor outlet module and the structural dynamics of the upper internal structure's first unengaged vibration mode was tested to determine if the flow from nine simulated fuel assembly nozzles would induce significant model vibrations. Fluidelastic vibration of the model was observed for two typical outlet module flow zones and for many orientations of the outlet module's flow collector with respect to a close packed configuration of nine fuel assembly nozzles. The fluidelastic vibration was characterized by a significant increase in the rate of change of vibration amplitude with increases in flow rate, once a threshold flow rate had been exceeded. (auth)

21489 (CONF-750607-24) STATUS OF THE CLINCH RIVER BREEDER REACTOR PLANT NUCLEAR STEAM SUPPLY SYSTEM. Jacobi, W. M. (Westinghouse Electric Corp., Baltimore, Md. (USA)). [nd]. 6p. Dep. NTIS $4.00.

From American Nuclear Society meeting; New Orleans, Louisiana, USA (8 Jun 1975).

The status of the CRBR project is reviewed. Major accomplishments have been achieved by the Project. Supporting the major milestones, system design descriptions and equipment specifications have been completed by the reactor manufacturers and architect engineer. Major milestone events, such as preparation of the Environmental Report and the Preliminary Safety Analysis Report, have been completed. (auth)

21490 (CONF-750810-1) INVESTIGATION OF TWO-PHASE LIQUID-METAL MAGNETOHYDRODYNAMIC POWER SYSTEMS. Amend, W. E.; Fabris, G.; Cutting, J. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-eng-38. 14p. Dep. NTIS $4.00.

From international seminar on future energy conversion in heat and mass transfer problems; Dubrovnic, Yugoslavia (25 Aug 1975).

A two-phase Liquid-Metal MHD (LMMHD) system is under development at the Argonne National Laboratory, and results are presented for detailed cycle analysis and systems studies, the experimental facility, and the thermal and magneto fluid mechanics problems encountered. The studies indicate that the LMMHD cycle will operate efficiently in the temperature range of 1000-1600°F (50% efficiency with a maximum cycle temperature of 1600°F) and is therefore potentially compatible with many advanced heat sources under development such as the LMFBR, fluidized-bed coal combustor, HTGCR and the fusion reactor. Of special interest is the coupling to the LMFBR thereby eliminating the costly, potentially hazardous liquid-metal/water interface. The results of detailed parametric studies of the heat transfer interfaces between an LMMHD power cycle and an LMFBR and a steam bottoming plant are described. Experimental evaluation of the two-phase LMMHD generator was performed in an ambient temperature NaK-N_2 facility at ANL. Results of these

experiments, performed to determine the operating characteristics of the device as a function of the various independent parameters and to investigate two-phase flow, are given. (auth)

21491 (CONF-750812-3) CLINCH RIVER BREEDER REACTOR PLANT. Hardigg, G. W. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). [nd]. 25p. Dep. NTIS $4.25.

From tenth intersociety energy conversion engineering conference; Newark, Delaware, USA (17 Aug 1975).

The planning and design activities for the Clinch River Breeder Reactor are reviewed. (JWR)

21492 (COO-2245-20TR) PREDICTION OF COOLANT TEMPERATURE FIELD IN A BREEDER REACTOR INCLUDING INTERASSEMBLY HEAT TRANSFER. Chen, B. C. J.; Todreas, N. E. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering). May 1975. Contract AT(11-1)-2245. 133p. Dep. NTIS $5.45.

A general procedure for investigating the effect of the interassembly heat transfer on the temperature field of a breeder reactor is provided. This procedure utilizes a simple multiassembly code, SUPERENERGY, and a set of normalized assembly maps derived from this code. This procedure was applied to the Clinch River Breeder Reactor to study the effect of including various concentric rings of coupled assemblies on the temperature prediction of the central assembly. Insignificant perturbation from the inclusions of second ring assemblies and important perturbation from the inclusion of first ring assemblies was found. (auth)

21493 (COO-2245-22TR) TURBULENT MOMENTUM EXCHANGE COEFFICIENTS FOR REACTOR FUEL BUNDLE ANALYSIS. Ninokata, H.; Todreas, N. E. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering). Jun 1975. Contract AT(11-1)-2245. 89p. Dep. NTIS $5.45.

A unified treatment of the turbulent and the molecular effects on the mixing coefficients has been performed and the momentum exchange coefficient evaluated for small triangular array rod bundles (19 pins and 37 pins) without spacers. These results are based on the output of the computer code "VELASCO" which performs the calculation of the velocity distribution within a fuel rod array. The results show that momentum exchange coefficients vary considerably with spatial position in the bundle. A method for deriving energy exchange coefficients as input data for COBRA analysis is presented. These energy exchange coefficients can be calculated by the method of this report when VELASCO or a similar distributed parameter code is developed to compute thermal fields within a fuel rod array. (auth)

21494 (GA-A-13298) POSTIRRADIATION EXAMINATION OF CHARCOAL TRAP IN IRRADIATION CAPSULE GB-9. Langer, S.; Buzzelli, G.; Flynn, P. W. (General Atomic Co., San Diego, Calif. (USA)). 28 May 1975. Contract AT(04-3)-167. 40p. Dep. NTIS $4.00.

A vented fuel rod containing mixed-oxide fuel, a urania axial blanket, and a fission-product charcoal trap was irradiated in GCFR irradiation capsule GB-9 in the Oak Ridge Research Reactor. The postirradiation examination of the charcoal trap from capsule GB-9 was carried out at General Atomic Company. The postirradiation examination is described, the axial distributions and concentrations of several cesium and iodine fission-product nuclides deposited in the trap are reported, and the fractional depositions and probable transport mechanisms are discussed. (auth)

21495 (GA—13423) REVIEW OF THE LITERATURE PERTINENT TO FISSION-PRODUCT MIGRATION AND INTERACTION IN FUEL RODS. Epstein, B. D. (General Atomic Co., San Diego, Calif. (USA)). 6 Jun 1975. Contract AT(04-3)-167. 39p. Dep. NTIS $4.00.

A survey of the available literature pertaining to the volatile fission-product activity in fast breeder reactor fuel has been conducted. This is an initial effort in the investigation of plate-out (or deposition) and potential plugging in the Gas-Cooled Fast Breeder Reactor (GCFR) fuel pressure-equalization system (PES). A review of the material surveyed and the results and conclusions reached with respect to pressure-equalized and vented GCFR fuel rods is presented. (auth)

21496 (GEAP-10028-51) CORE ENGINEERING. Fifty-First Quarterly Report, May–July 1974. (General Electric Co., Sunnyvale, Calif. (USA). Breeder Reactor Dept.). May 1974. Contract AT(04-3)-893. 85p. AT.

Progress is described for tasks related to fuel rods, fuel rod assemblies, core restraint, and control and blanket assemblies. (auth)

21497 (GEAP-10028-52) CORE ENGINEERING. Fifty-Second Quarterly Report, August–October 1974. (General Electric Co., Sunnyvale, Calif. (USA). Breeder Reactor Dept.). Nov 1974. Contract AT(04-3)-893. 48p. AT.

Progress is described for tasks related to grid spaced driver assembly, wire-wrap assembly engineering, structural design criteria, and probabilistic design. (auth)

21498 (GEAP-10028-53) CORE ENGINEERING. Fifty-Third Quarterly Report, November 1974–January 1975. (General Electric Co., Sunnyvale, Calif. (USA). Breeder Reactor Dept.). Feb 1975. Contract AT(04-3)-893. 38p. AT.

Progress is described for tasks related to grid spaced driver assembly, wire-wrap assembly engineering, structural design criteria, and probabilistic design. (auth)

21499 (GEAP–14032-2) REFERENCE FUEL STUDIES SECOND QUARTERLY REPORT, NOVEMBER 1974–JANUARY 1975. (General Electric Co., Sunnyvale, Calif. (USA). Breeder Reactor Dept.). 1975. Contract AT(04-3)-893. 67p. AT.

A thermodynamic data program involving plutonia and urania at high temperatures, fuel rod engineering, and fuel rod test program are described. (auth)

21500 (GEAP–14039-1) ADVANCED OXIDE FUEL SYSTEMS DESIGN AND TRADE-OFF STUDIES. First Quarterly Report, July–November 1974. (General Electric Co., Sunnyvale, Calif. (USA). Breeder Reactor Dept.). Jan 1975. Contract AT(04-3)-189. 44p. AT.

Initial reference plant designs were prepared for a 1200 MW(e) and a 2000 MW(e) LMFBR. Scoping thermal/hydraulic, mechanical and neutronic calculations were performed to assure design consistency. Parametric studies were performed to determine thermal/hydraulic, mechanical and neutronic performance parameters as functions of plant operating conditions and design variables. This information will be used to form constraint relations to be applied to design trade-off and optimization efforts. Initial specifications were prepared and programming activities initiated on COROPT, a computer code for performing design trade-off and optimization studies. A reactor physics design analysis was completed for the initial 1200 MW(e) and 2000 MW(e) designs. Revisions to the 1200 MW(e) and 2000 MW(e) reference designs have been carried out based on detailed orificing and thermal/hydraulic analyses. An evaluation of linear power design limits has been carried out using the PEFT code. Sensitivity studies on fuel cycle cost, doubling time and breeding ratio were completed. 10 references. (auth)

21501 (GEAP–14045-1) RELIABILITY PROGRAM FOR SHUTDOWN HEAT REMOVAL. First Quarterly Report, July 1974–February 1975. (General Electric Co., Sunnyvale, Calif. (USA). Breeder Reactor Dept.). Mar 1975. Contract AT(04-3)-893. 19p. AT.

The objectives of the LMFBR Shutdown Heat Removal (SHR) Reliability Program are to assess analytically and empirically the reliability of heat removal systems to remove heat from the reactor after scram or normal shutdown and to provide technology for assuring that reliability objectives are achieved. The Reliability Engineering Tasks encompassed by this program fall into twelve major areas: (1) Planning, (2) Methods Development, (3) Goals and Apportionments, (4) Reliability Predictions, (5) Data Assessments, (6) Reliability Analyses, (7) Test Planning, (8) Testing, (9) Management, Review and Audit, (10) System Assessment, (11) Final Reliability Report, and (12) Operational Reliability. LMFBR SHR Reliability Program activities and the results of these activities from July 1974 through February 1975 are described. The majority of effort to date has been concentrated on initiating and implementing reliability tasks for the Clinch River Breeder Reactor Plant (CRBRP). 3 references. (auth)

21502 (HEDL-TME-74-30) SOME ASPECTS OF CONTINUUM PHYSICS USED IN FUEL PIN MODELING. Bard, F. E. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Jun 1975. Contract AT(45-1)-2170. 154p. Dep. NTIS $5.45.

The mathematical formulation used in fuel pin modeling is described. Fuel pin modeling is not a simple extension of the experimental and interpretative methods used in classical mechanics. New concepts are needed to describe materials in a reactor environment. Some aspects of continuum physics used to develop these new constitutive equations for fuel pins are presented. (auth)

21503 (HEDL-TME-74-47(Vol.1)) MELT-III: A NEUTRONICS, THERMAL-HYDRAULICS COMPUTER PROGRAM FOR FAST REACTOR SAFETY ANALYSIS. Volume I. Waltar, A. E.; Partain, W. L.; Kolesar, D. C.; O'Dell, L. D.; Padilla, A. Jr.; Sonnichsen, J. C.; Wilburn, N. P.; Willenberg, H. J. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Dec 1974. Contract AT(45-1)-2170. 495p. Dep. NTIS $13.60.

The Melt-III program is a multichannel, neutronics, thermal-

hydraulics digital computer program developed to investigate the transient behavior of a fast reactor during postulated accident conditions. Reactivity feedback resulting from Doppler broadening, coolant density change and expulsion, bulk core expansion, and fuel movement are explicitly taken into account. Although a wide variety of accident conditions may be investigated, particular modeling emphasis has been placed on the simulation capabilities for an unprotected transient overpower accident sequence. The bulk of the modeling detail has been addressed to the in-vessel portion of the reactor plant, although the friction and inertial aspects of up to three separate closed primary loops can be simulated. The conservation equations for continuity, momentum, and energy are solved using a pressure boundary condition at the inlet and outlet plenums. This condition is used to hydraulically couple channels which have common plenums. The MELT-III program was originally written for the UNIVAC 1108 computer, but has been converted to an advanced CDC-6600 (CYBER-74) and a CDC-7600. Modular construction is used in that only a single channel is in the computer code memory at any one time. This feature allows considerable room for future modeling improvements, and provides no inherent limitation on the total number of reactor channels which can be modeled—other than the extent of peripheral storage available. (auth)

21504 (HEDL-TME-75-28) MECHANICAL PROPERTIES DURING SIMULATED OVERPOWER TRANSIENTS OF FAST REACTOR CLADDING IRRADIATED FROM 700–1000°F. Hunter, C. W.; Johnson, G. D.; Fish, R. L. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Jun 1975. Contract AT (45-1)-2170. 101p. AT.

Internally pressurized specimens of fast flux-irradiated 20% cold worked Type 316 stainless steel fuel pin cladding were rapidly heated until they burst in order to determine mechanical behavior under various simulated reactor transient events. Tests were conducted at heating rates of 10°F/sec and 200°F/sec with pressures of 2500 to 13,500 psi, resulting in failure temperatures from 1000 to 2000°F. The test specimens were taken from NUMEC F, PNL-10 and PNL-11 fuel pins, which had been irradiated in EBR-II at temperatures from 700 to 1000°F and peak linear power levels from 8.7 to 11.5 KW/ft. Peak burnup and fluence levels ranged from 28,000 to 50,000 MWd/MTM and 2.5 to 4.3 x 10^{22} n/cm^2 (E > 0.1 MeV), respectively. Irradiation degraded both the failure strain and failure strength, when the transient test conditions resulted in intergranular fracture; intergranular fracture occurred about 1000 to 1200°F, depending on strain rate. A correlation, based on the ratio of irradiated material failure strain and failure strength was developed to describe the effects of irradiation on the mechanical properties of the cladding. The strain ratio correlation indicates that the failure strain does not further decrease beyond a fluence of 2 × 10^{22} n/cm^2. Five forms of cladding wastage were identified. Inner surface grain boundary attack or cracking produced the most deleterious effects on mechanical properties. The mechanical properties of cladding which had contained fuel during irradiation were degraded more than were the properties of unfueled material. (auth)

21505 (HEDL-TME-75-51) EXPOSURE OF PRECRACKED AND PRELOADED FRACTURE MECHANICS SPECIMENS IN LIQUID SODIUM, WITH AN INTERMEDIATE MOIST NITROGEN CLEANING. James, L. A.; Borisch, R. R. (Hanford Engineering Development Lab., Richland, Wash. (USA)). May 1975. Contract AT(45-1)-2170. 21p. Dep. NTIS $4.00.

A survey is presented on the applicability of fracture mechanics techniques in characterizing the potential for crack extension when reactor components are removed from service in a sodium environment, cleaned, and subsequently returned to service. It was felt that sodium remaining in a sharp crack after a component is removed from service could react with the cleaning environment and, with the application of tensile stresses, result in environmentally aggravated crack extension. Precracked and preloaded fracture mechanics specimens were exposed to sodium, cleaned, returned to sodium environment, and finally examined. No crack extension occurred in any of the statically loaded specimens during the test. (auth)

21506 (LA-tr-75-14) LAYOUT, IRRADIATION, AND POST-IRRADIATION-EXAMINATION OF THE SHORT-TIME, MIXED-CARBIDE-IRRADIATION-EXPERIMENT LOOP-4A. Weimar, F.; Fiedler, H. (Kernforschungszentrum Karlsruhe (F.R. Germany)). 1975. Translation of. 95p. Dep. NTIS $7.75.

As a possible fissionable fuel, uranium carbide stands at the center of the PSB program to develop a high-quality fuel for the fast breeder. Irradiation experiments to show both the long-term and initial behavior of the uranium carbide are described. The initial behavior is tested in the FR 2-Central-Loop by means of a device which allows the experimenter to move the test sample in, out, and to a new height while the reactor is running. The experimental group comprises 8 test bodies with central thermoelements, with various large radial clearances between the casing tube and the carbide pellet. All details concerning the 8 test bodies of this experimental group are given. These details include a statement of the problem, the layout, specifications, production of the test bodies, radiation course, non-destructive and destructive post-irradiation examination as well as calculations with the fuel rod-computer program SATURN. (20 references) (auth)

21507 (LFEN-165-b) DATA ACQUISITION AND PROCESSING SYSTEM FOR REACTOR NOISE ANALYSIS. Oliveira, J. M. C.; Veiga, C. M.; Trigueiros, D. F.; Duarte, J. M. P. (Junta de Energia Nuclear, Sacavem (Portugal). Lab. de Fisica e Engenharia Nucleares). 1974. 22p. INIS.

6 figs. Paper presented at the specialist meeting on reactor noise in Rome, 21st-25th October 1974.

A data acquisition and processing system for reactor noise analysis by time correlation methods is described, consisting in one to four data feeding channels (transducer, associated electronics and V/f converter), a sampling unit, a landline transmission system and a PDP 15 computer. This system is being applied to study the kinetic parameters of the "Reactor Portugues de Investigacao", a swimming-pool 1 MW reactor. (auth)

21508 (LMEC-TDR-75-4) SODIUM LEVEL TRANSDUCER TESTING TO 1200°F. Fischer, B. E. (Liquid Metal Engineering Center, Canoga Park, Calif. (USA)). 15 Jul 1975. 464p. AT.

The results of the second phase of a test program being conducted at the Liquid Metal Engineering Center (LMEC) on a group of level transducers to determine their performance characteristics are described. The transducers tested included inductive transducers procured from MSA Co., GEC Reactor Equipment Ltd., and Interatom, Bensburg, Germany; displacer-float transducers procured from Fisher Controls Co.; delta-pressure transducers from Barton Instrument Co.; and a time domain reflectometry level transducer. Sodium testing included calibrations from 500 to 1200°F and exposure at 1200°F for over 2000 hr. (auth)

21509 (RD/B/N-3195) EFFECT OF LIQUID SODIUM ON THE TENSILE AND CREEP-RUPTURE PROPERTIES OF INCOLOY-800: A PRELIMINARY STUDY. Cordwell, J. E.; Nicholson, R. D. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Feb 1975. 22p. Dep. NTIS (US Sales Only) $4.25.

Liquid metal embrittlement has previously been proposed as a possible explanation for the reduced creep rupture ductility and lifetime of Incoloy 800 in sodium. Specimens of Incoloy 800 with centrally drilled holes were tensile tested in sodium and argon in the temperature range 250°C to 700°C following grade I (1000°C, 1 h, air cooled) heat treatment. Only at 700°C were the tensile properties significantly affected. These experiments were followed by a preliminary study of creep crack propagation in sodium at 700°C. (auth)

21510 (WAPD-TM-1172) CHEMICAL AND SPECTROCHEMICAL PRODUCTION ANALYSIS OF ThO_2 AND $^{233}UO_2$-ThO_2 PELLETS FOR THE LIGHT WATER BREEDER REACTOR CORE FOR SHIPPINGPORT (LWBR DEVELOPMENT PROGRAM). Bukowski, J. F.; Hollis, E. D. (Bettis Atomic Power Lab., West Mifflin, Pa. (USA)). Jun 1975. Contract AT(36-1)-GEN-14. 119p. Dep. NTIS $9.00.

The Bettis Atomic Power Laboratory has utilized wet chemical, emission spectrochemical, and mass spectrometric analytical techniques for the production analysis of the ThO_2 and $^{233}UO_2$-ThO_2 (1 to 6 wt percent $^{233}UO_2$) pellets for the Light Water Breeder Reactor (LWBR) core for Shippingport. Proof of the fuel breeding concept necessitates measurement of precise and accurate chemical characterization of all fuel pellets before core life. Chemistry's efforts toward this goal are presented in three main sections: (1) general discussions relating the chemical requirements for ThO_2 and $^{233}UO_2$-ThO_2 core materials to the analytical capabilities, (2) technical discussions of the chemical and instrumental technology applied for the analysis of aluminum, boron, calcium, carbon, chloride plus bromide, chromium, cobalt, copper, dysprosium, europium, fluoride, gadolinium, iron, magnesium, manganese, mercury, molybdenum, nickel, nitrogen, samarium, silicon, titanium, vanadium, thorium, and uranium (total, trace, and uranium VI), and (3) a formal presentation of the analytical procedures as applied to the LWBR Development Program. (auth)

21511 (WARD-HT-3045-10) SIMPLIFIED INELASTIC (PLASTIC AND CREEP) ANALYSIS OF PIPE ELBOWS IN SUPPORT OF THE MLTF. Mello, R. M.; Griffin, D. S.; Scheller, J. D. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Jun 1975. Contract E(11-1)-3045. 76p. AT.

The inelastic analysis of pipe elbows typical of those to be tested in the Multiload Test Facility (MLTF) is described. These analyses were performed for use in the design of the MLTF test fixture and instrumentation. These analyses have also served to establish the basis and procedures for the analyses to be performed in correlating predicted and experimental data. The inelastic analyses were made using a nonlinear finite element computer program which takes into account the effects of material strain hardening, stress redistribution, creep/relaxation, and cross-sectional ovalization of the pipe elbow. Detailed information on stresses, plastic and creep strains, and deformations throughout the pipe elbow bodies resulting from elastic/plastic, elastic/plastic/creep, and elastic/plastic-creep/relaxation material behavior was obtained for the cases of applied inplane and out-of-plane moment loading on the elbows. 21 references. (auth)

21512 (WARD-NA-3045-25) STABILITY OF EXTRANEOUS ARTIFACTS IN LIQUID SODIUM. Meacham, S. A.; Whitlow, G. A. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). 1975. Contract E(11-1)-3045. 42p. AT.

Various materials considered likely to be associated with construction, cleaning, and inspection of a nuclear power plant were exposed to sodium and examined for physical stability. The materials included such items as wood, cotton, plastics, asbestos, and graphite. Sodium exposures at 400°, 730°, and 995°F for prolonged periods of time, up to one month, were conducted. It was determined that a one-day exposure to 995°F sodium will produce friable material in all but one of the artifacts tested. In addition, a two-week exposure to 730°F argon produced nearly the same physical condition as in the 730°F sodium experiments. Recommendations for a potential cleanup procedure prior to sodium fill of the plant are presented. (auth)

21513 (WARD-RB-3045-9) RADIAL BLANKET DESIGN AND DEVELOPMENT. Progress Report for Period Ending February 28, 1975. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). 1975. Contract E(11-1)-3045. 94p. AT.

Information is presented concerning LMFBR radial blanket assembly heat transfer testing, radial blanket fuel and assembly irradiation testing, radial blanket flow orificing test, and radial blanket rod bundle compaction tests. (DCC)

21514 SAFETY MARGINS FOR SODIUM-BONDED CARBIDE FUEL. Siegmann, E. R.; Gilbertson, J. C. (Combustion Engineering, Inc., Windsor, CT). Nucl. Technol.; 26: No. 4, 452-459(Aug 1975).

The consequences of the loss of bond in a sodium-bonded pin were considered. Experiments and previous analyses were reviewed. New calculations were performed and indicated that loss of bond could lead to fuel redistribution within the clad but not to clad failure. Fuel-coolant interactions with carbide fuel were also considered. Interface temperatures between molten fuel and sodium were determined and applied to the Fauske criterion for spontaneous nucleation. Results indicate that rapid sodium vaporization is not likely with carbide fuel. Upper limit work-energy yields were calculated for sodium contact with molten oxide and carbide fuels using SOCOOL-II code. Temperatures, properties, and geometry were varied to determine the relative dependency of the results. The yields were very similar for the carbide and oxide and varied more with the boundary conditions than with the type of fuel. 12 references. (auth)

21515 OPTIMUM PIN DIAMETER FOR LMFBR CARBIDE FUELS. Noyes, R. C.; Doherty, P. K.; Caspersson, S. A.; Hanus, N.; Stuteville, D. W. (Combustion Engineering, Inc., Windsor, CT). Nucl. Technol.; 26: No. 4, 460-471(Aug 1975).

A study to determine the optimum pin diameter for carbide fuel in a liquid-metal fast breeder reactor was made. Several subsidiary parameters, including coolant velocity, burnup, and properties of the clad and subassembly duct material, were studied for their effect on the optimum pin diameter. The materials used in the analysis were Type 316 stainless steel and a high strength, low swelling material capable of operation to a damage fluence of 3.6×10^{23} n/cm^2. Using doubling time and fuel cycle cost as the basis for judgment, an optimum pin outer diameter (o.d.) range of 0.37 to 0.40 in. was found for both the near-term and advanced structural materials. Because of practical limits of the Fast Test Reactor testing, an o.d. of 0.37 in. is recommended. The optimum pin diameter was found to be independent of fuel burn-up. From a doubling time point of view, no incentive was found for development of carbide fuel with a burnup greater than 80 to 90 MWd/kg. 10 references. (auth)

21516 OUTLINE OF WATER FLOW TESTING FACILITY AND TEST RESULTS FOR ONE AND A HALF YEARS. Hayano, M.; Ishibashi, E. (Power Reactor and Nuclear Fuel Development Corp., Oarai, Ibaraki (Japan). Oarai Engineering Center). Doryokuro Giho; No. 10, 62-72(Mar 1974). (In Japanese).

The main object of the water flow testing facility is to put the basic data for use in designing a prototype fast breeder reactor "Monju" by testing sodium instrumentations and structures in the facility before using them in liquid sodium. Before testing the objects, the partial test of each object and the preliminary test with one-fifth scale models were carried out. The instrumentations and structures tested were a 22B sluice valve, a 26B non-return valve, a one-half model of the reactor pressure vessel and a one half model of the intermediate heat exchanger. In the water flow testing facility, the water for the experiment is pumped up and goes through a 100 mesh filter, a surge tank, a change-over valve, an electromagnetic flow meter, and a valve test station or a flow model station, and goes back to a storage tank. In the future, a flow safety test at the time of breakdown of piping, a water flow test of large size valves, and a water flow test of fuel assemblies will be performed. (JA)

21517 THERMAL LOADING TEST BY SODIUM USING HIGH TEMPERATURE STRAIN GAGES. Miyazono, S.; Kodaira, T.; Matsumoto, M. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment); Ito, K.; Wada, H. Hihakai Kensa; 23: No. 8, 440-444(Aug 1974). (In Japanese).

Due to the abrupt change of sodium temperature in LMFBR emergency shutdown, large thermal strain of the components is anticipated. A nozzle of a pressure vessel was installed in an experimental sodium loop and the temperature change and thermal strain of the nozzle were measured when the sodium temperature around its inner corner was abruptly changed. The following matters were revealed: (1) The severest temperature change, about 9°C/s, occurred at the inner corner of the nozzle. (2) The maximum temperature difference at the nozzle corner was about 100°C. (3) Separation of the thermal strains due to pipe reaction, external constraint and temperature difference is difficult; a comparative study with the results of calculations is necessary. (4) Due to the combined three loads at the outer nozzle corner, a radial stress of about 32 kg/mm^2 was caused in thermal shock. (JA)

21518 FUEL ELEMENT FOR FAST REACTOR. Kawada, T.; Ishihata, A. (To Tokyo Shibaura Electric Co. Ltd., Kawasaki, Kanagawa (Japan)). Japanese Patent 1973-7026/B/. 8 Nov 1969. 3p. (In Japanese).

A fuel element for a fast reactor requires a sheathing pipe of small diameter. In order to establish a uniform density over the full length of the sheathing pipe in spite of its small diameter, the fuel element must be charged with fuel particles of different compositions and separated into the respective composition compartments. It is accordingly constructed of a blanket fuel section, a reactor core fuel section, and another blanket fuel section. However, merely separating the fuel sections caused the fuel particles of the different compositions to mingle in the boundary regions, with the result that the thermal characteristics of the fuel vary and that the reprocessing efficiency of the spent fuel lowers. A cylindrical sintered pellet has heretofore been inserted at the boundary in order to prevent the compositions from mingling, but local changes in the thermal and irradiation performance have arisen due to the nature of the pellet which is different from that of the fuel. According to this invention, using vibrational charging, fuel particles of irregular shapes having particle sizes of about 8 to 20 meshes are brought into each boundary region over a length at least twice as large as the inner diameter of the sheathing pipe. The sintered pellets are dispensed with, and the separation is achieved by a simple procedure. (JA)

21519 FUEL ELEMENT FOR NUCLEAR REACTORS. Lesser, R. (to Commission of the European Communities). Netherlands Patent 7,114,862/A/. 28 Oct 1971. 6p. (In Dutch).

The invention provides fuel elements for fast breeder reactors whereby both the fuel and the fertile materials consist of oxides and carbides of the following actinides: thorium, uranium and plutonium. A metallic actinide is used as a "getter" metal for the superfluous oxide or carbide of thorium, uranium or plutonium and is added to the central cylinder of fertile material surrounded by fuel. In this way the corrosion of the fuel can is minimized. (NL)

21520 CZECHOSLOVAK-SOVIET COOPERATION IN SHIELDING PHYSICS. Burian, J.; Rataj, J. (Ustav Jaderneho Vyzkumu, Rez, Czech.). Jad. Energ.; 21: No. 5, 167-172(Mar 1975). (In Czech).

The paper deals with the development of the Czechoslovak Soviet cooperation in this field. A new stage of the cooperation is proved by the solution of a contemporary problem in shielding physics — a problem of neutron penetration through sodium-filled

pipes of the fast reactor. The development of calculation methods, above all the application of Monte-Carlo method is briefly described. Within the framework of the experimental solution of the problem, the preparation of the experiment and its realisation on the reactor VVR-S are described. The most important results for straight pipes are given. 10 references. (auth)

21521 IMPROVED PREDICTION OF CRITICAL HEAT FLUX IN LIQUID METAL POOL BOILING. Bankoff, S. G. (Northwestern Univ., Evanston, IL); Fauske, H. K. pp 241-244 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

The Kutateladze criterion for the pool boiling critical heat flux, which works well for nonmetallic liquids at or above atmospheric pressure, fails for the alkali liquid metals in the pressure range of interest for Liquid Metal Fast Breeder Reactor applications. In this pressure range bubble growth of the alkali liquid metals is largely inertia-controlled, in view of the large thermal conductivities, which implies a significant condensing heat flux within the bubbles themselves. The bubble growth is assumed to be described by the Mikic, Rohsenow, and Griffith equation. In this way a mean bubble age is determined, and hence a mean bubble thermal boundary layer thickness. The time-average critical heat flux is then obtained as the sum of the Kutateladze flux and the flux due to condensation on the bubble surfaces. No empirical parameters are employed. The present analysis predicts critical heat fluxes lying generally within the data band. (auth)

Research, Test, and Experimental Reactors

Refer also to abstracts 21504 and 21639.

21522 (AAEC/E-345) ANALYSIS OF POWER TRANSIENTS OBSERVED IN SPERT I REACTORS. Part I. Transients in Aluminium Plate-Type Reactors Initiated at Ambient Temperature. Clancy, B. E.; Connolly, J. W.; Harrington, B. V. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Mar 1975. 28p. Dep. NTIS (US Sales Only) $4.50.

An investigation of SPERT I reactor reactivity feedback mechanisms has been made using the modular code AUS. Feedback terms so obtained have been used in the transient analysis code ZAPP to calculate transient behaviour for step and ramp reactivity additions. A simple model of coolant boiling has been used to analyse transients for which cladding temperatures exceed the saturation temperature of water. The generally good agreement obtained with experimental data supports the case that core only temperature coefficients are much larger than those obtained by heating core and reflector. 10 references. (auth)

21523 (CONF-750804-6) NATURAL CIRCULATION COOLING OF FFTF CLOSED LOOP TEST SECTIONS DURING REMOVAL FROM REACTOR. Coffield, R. D.; Miller, J. V. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Oct 1974. Contract AT(45-1)-2171. 16p. Dep. NTIS $4.00.

From conference on heat transfer; San Francisco, California, USA (11 Aug 1975).

Analytical results and experimental data on the natural convection cooling of FFTF fuel assemblies during removal from the reactor are compared. (JWR)

21524 (CONF-750812-10) TEMPERATURE CONTROL WITH HIGH PERFORMANCE GRAVITY-ASSIST HEAT PIPES. Kemme, J. E.; Deverall, J. E.; Keddy, E. S.; Phillips, J. R.; Ranken, W. A. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-ENG-36. 6p. Dep. NTIS $4.00.

From 10th intersociety energy conversion engineering conference; Neward, Delaware, USA (17 Aug 1975).

The development of high performance heat pipes for controlling the temperature of irradiation experiments in the Experimental Breeder Reactor (EBR-II) is described. Because this application involves vertical operation in a gravity-assist mode with the evaporator down, several tests were made with sodium and potassium heat pipes in this position to establish their performance limits as a function of operating temperature. Best performance was achieved with a new wick structure consisting of a fine porous liner next to the heat-pipe wall and four helical channels next to the vapor passage. Also, a new modification of heat-pipe theory was discovered for determining performance limits for this type of wick. In its most rudimentary form, this modification says that the dynamic pressure gradient in the vapor stream cannot exceed the gravity gradient causing return of liquid. Once this modification was expressed in the form of a limiting equation, and a term was added to account for the slight capillary force developed in the channels, good agreement was obtained between calculated limits and those measured in several tests with both sodium and potassium. These tests showed rather conclusively that only half of the liquid head in the evaporator section was causing return of condensate, whereas existing theory predicts that the full head of liquid in the heat pipe is available for condensate return. (auth)

21525 (CNEN-RT/PROT-74-24) DYNAMS: DYNAMICS OF AN EXPERIMENTAL LIQUID-METAL COOLED FAST REACTOR. Scafe, R. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). 1974. 138p. (In Italian). INIS.

A program for the analysis of operational or accident transients of a liquid-metal cooled fast reactor which dissipates in the atmosphere the heat produced is presented. The program calculates the temperature distribution and the coolant flow in the components of three coolant loops: the loops are of two different types and each of them is composed of a primary, a secondary and a tertiary. The code can take into account both natural circulation and the distributed component of heat losses. Longitudinal thermal conduction in the liquid metal and thermal losses are not taken into account. The program is written in FORTRAN IV for IBM 370/165 computers. (auth)

21526 (DP-1367) METHOD OF ANALYSIS TO DETERMINE SUBCRITICAL REACTIVITY FROM THE PULSED NEUTRON EXPERIMENT. Parks, P. B. (Du Pont de Nemours (E.I.) and Co., Aiken, S.C. (USA). Savannah River Lab.). Jun 1975. Contract AT(07-2)-1. 43p. Dep. NTIS $4.00.

The published methods for the deduction of reactivity from pulsed neutron experiments on subcritical reactors are reviewed. Each method is categorized as inherently yielding a result that is either spatially independent or spatially dependent. The spatially independent results are formally identical with the static reactivity; the result does not depend, in principle, on the location of either the pulsed neutron source or the neutron detector during data collection. The spatially dependent results only approximate the static reactivity; the results are affected, in varying degrees, by the locations of the source and detector. Among the techniques yielding spatially independent results are the Space-Time method of Parks and Stewart and the Inhour method of Preskitt, et al. Spatially dependent results are obtained with the Sjoestrand, Gozani, and Garelis-Russell methods which are examined with and without the kinetic distortion corrections given by Becker and Quisenberry. Intercomparisons of all methods are made with reference to pulsed neutron experiments on both unreflected and reflected reactors. Recommendations are made concerning the best choice of method under the various experimental conditions that are likely to be encountered. 14 references. (auth)

21527 (EIR-251-2) STUDY OF THE ^{17}F ACTIVITY AS A NUCLEAR POWER MONITOR AT THE HEAVY WATER REACTOR DIORIT. Part II. Measurement Installation. Behringer, K.; Leoni, B.; Pruys, H. S. Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Feb 1974. 84p. (In German). Dep. NTIS (US Sales Only) $7.25.

The measurements made with the devices described in EIR-251-1 are described and typical results are given. The proportionality of the ^{17}F activity in a power increase, the dynamic response of the ^{17}F monitor, and the behavior of the monitor during a power decrease are reported. The possibilities of ^{19}O determinations, dependence of the monitor on the D_2O circulation in the primary circuit, and the effect of strong neutron flux asymmetry are considered. The results showed that the ^{17}F activity can be used as a monitor of the fission neutron flux or the nuclear power. Corrections which must be made to the monitor reading are given from experimental determinations. (JSR)

21528 (EUR-5312e) HIGH FLUX MATERIALS TESTING REACTOR (HFR) PETTEN. Annual Report, 1973. (Commission of the European Communities, Petten (Netherlands). Joint Nuclear Research Center). 1974. 92p. Dep. NTIS (US Sales Only) $7.75. EUR B. Fr. 250.-.

This report outlines the work performed in 1973 under the HFR programme. The continuation of the activities around the reactor in the scope of a complementary programme has been decided by the Council of Ministers of the European Community in February, 1973. The HFR programme comprises the operation of the Petten High Flux Reactor and the design, construction and operation of experiments. (auth)

21529 (GSF-P-81) ANNUAL REPORT 1974. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (F. R. Germany). Physikalisch-Technische Abt.). Feb 1975. 75p. (In German). INIS.

With figs.; tabs. and refs.

Aside from routine work for reactor operation and irradiation, most of the work done in the FRN reactor was connected with the

expansion of the experimental capacity and with problems of activation analysis. About 4,000 gamma and neutron irradiations were carried out, most of them for neutron activation. The tracer element analysis laboratory continued its analyses of environmental specimen. (INIS)

21530 (HEDL-SA-680) SPECIFYING AND MANUFACTURING PIPING FOR THE FAST FLUX TEST FACILITY. Moen, R. A.; O'Keefe, D. P.; Irvin, J. E.; Tobin, J. C. (Hanford Engineering Development Lab., Richland, Wash. (USA)). 19 Apr 1974. Contract AT(45-1)2170. 25p. (CONF-740606-21). Dep. NTIS $4.25.

From pressure vessels and piping-materials-nuclear conference; Miami Beach, Florida, USA (24 Jun 1974).

Specification of materials for liquid metal reactor coolant piping, at service temperatures up to 1200°F, involves a number of considerations unique to these systems. The mechanical property/design allowable stress considerations which led to the selection and specification of specific materials for the Fast Flux Test Facility piping are discussed. Additional considerations are described indicating allowances made for material changes anticipated in service. These measures primarily involved raising the minimum carbon content to a value that would insure the strength of the material always remains above that assumed in the initial design, although other considerations are discussed. The processes by which this piping was manufactured, its resulting characteristics and methods of subsequent handling/assembly are briefly discussed. (auth)

21531 (HEDL-SA-933) FFTF FUEL PIN DESIGN BASES AND PERFORMANCE. Cox, C. M.; Hanson, J. E.; Roake, W. E.; Slember, R. J.; Weber, C. E.; Millunzi, A. C. (Hanford Engineering Development Lab., Richland, Wash. (USA); Energy Research and Development Administration, Washington, D. C. (USA)). Apr 1975. Contract AT(45-1)2170. 35p. (CONF-750411-9). Dep. NTIS $4.75.

From European nuclear conference; Paris, France (21 Apr 1975).

The FFTF fuel pin was conservatively designed to meet thermal and structural performance requirements in the categories normal operation, upset events, emergency events, and hypothetical, faulted events. The fuel pin operating limits consistent with these requirements were developed from a strong fuel pin irradiation testing program scoped to define the performance capability under relevant steady state and transient conditions. Comparison of the results of the irradiation testing program with design requirements indicates that the FFTF fuel pin can exceed its goal burnup of 80,000 MWd/MTM. (auth)

21532 (HEDL-TME-75-15) MECHANICAL PROPERTIES OF FFTF PRIMARY OUTLET PIPING. Steichen, J. M. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Jan 1975. Contract AT(45-1)-2170. 41p. AT.

The elevated temperature mechanical properties of large diameter (28 inches) seamless pipe produced by roll extrusion for use as primary piping for sodium coolant in the Fast Flux Test Facility (FFTF) have been characterized. The three heats of Type 316H stainless steel piping material used in this study exhibited very consistent mechanical properties and chemical compositions. Tensile and creep-rupture properties exceeded values on which the allowable stresses for ASME Code Case 1592 on Nuclear Components in Elevated Temperature Service were based. Tensile strength and ductility were essentially unchanged by aging in static sodium at 1050°F (566°C) for times to 10,000 hours. High strain rate tensile tests showed that tensile properties were insensitive to strain rate at temperatures to 900°F (482°C) and that for temperatures of 1050°F (566°C) and above both strength and ductility significantly increased with increasing strain rate. Fatigue-crack propagation properties were comparable to results obtained on plate material and no differences in crack propagation were found between axial and circumferential orientations. (auth)

21533 (INIS-mf-1775) THE SWISS FEDERAL INSTITUTE FOR REACTOR RESEARCH, WUERENLINGEN. Programme and Organization. (Eidgenoessisches Inst. fur Reaktorforschung, Wuerenlingen (Switzerland)). Mar 1973 .p. (In German). INIS.

The brochure gives a brief survey of the history of the Swiss Federal Institute for Reactor Research at Wuerenlingen and mentions its duties i.e., research and education as well as different services especially aid and advice to authorities and industries. The installations namely the reactors SAPHIR, DIORIT, and PROTEUS are described as well as the different departments of the institute and their activities. (INIS)

21534 (KFK-tr-449) VARIABLE MECHANICAL STRESSES INDUCED BY POWER PULSES IN THE FUEL CANS OF THE IBR-30 REACTOR. Dmitriev, V. S.; Il'inskaya, L. S.; Pogodaev, G. N.; Podnebesnov, V. V.; Rogov, A. D.; Rudenko, V. T.; Shatskaya, O. A. (Kernforschungszentrum Karlsruhe (F. R. Germany). Literaturabteilung). Mar 1975. (JINR-P-13-8045). 18p. (In German). INIS.

9 figs. Translated from Russian, Dubna 1974.

Deformations and mechanical stresses induced by a thermal shock in the fuel can are determined experimentally. Experimental layout and method of measurement is described in detail. The most important measurements were carried out during operation of the IBR-30 with a slow pulse train at a frequency of 0.2 Hz and a mean reactor output of up to 15 kW. (GE)

21535 (NP-20504) INDUSTRIAL REACTOR LABORATORIES DISMANTLING PLAN. (ATCOR, Inc., Peekskill, N. Y. (USA)). 10 Jun 1975. 43p. ATCOR, Inc., Peekskill, NY.

For Industrial Reactor Labs., Inc., Plainsboro, NJ.

Plans for the dismantling of the IRL Reactor are presented. The dismantling operations to be performed are described and the safety aspects of dismantling are discussed. (JWR)

21536 (ORNL-TM-4938) OAK RIDGE RESEARCH REACTOR QUARTERLY REPORT OCTOBER, NOVEMBER, AND DECEMBER OF 1974. Hurt, S. S. III; Lance, E. D. (Oak Ridge National Lab., Tenn. (USA)). Jul 1975. Contract W-7405-eng-26. 29p. Dep. NTIS $4.50.

The ORR operated at an average power level of 29.8 Mw for 85.7% of the time during October, November, and December of 1974. Thirty-six fuel elements were declared spent (49.2% average burnup) during the quarter, while nineteen new elements were placed in service. Two shim rod elements were retired from service at an average burnup of 61.4%. The reactor was shutdown on nine occasions, one of which was unscheduled. End-of-Cycle shutdowns accounted for 87.3% of the total downtime. The remaining downtime was used principally for refueling and experiment work. (auth)

21537 (ORNL-TM-4963) BEARINGS FOR THE HFIR CONTROL PLATES. Abbatiello, A. A. (Oak Ridge National Lab., Tenn. (USA)). Aug 1975. Contract W-7405-eng-26. 30p. Dep. NTIS $4.50.

Recent accelerated wear of HFIR bearings seems to be a more advanced stage of the situation encountered in 1967. The latest observations are in agreement with the hypothesis that high-frequency impact loads at a 30° angle on these bearings are the apparent basic cause of their short life. In view of the limited possibilities for change at this stage of HFIR operation, the region of best payoff seems to be an increase in the load-carrying area at some acceptable sacrifice of low rolling friction. On this basis three types of bearings are proposed for test–two of these are journal types and one is a slider type. The next planned shutdown for maj · parts replacement provides an opportunity to test these modified bearing types in the HFIR under full mechanical operating conditions but without nuclear operation. The program is recommended for consideration and adoption. (auth)

21538 (RT/FI-(75)2) BUCKLING MEASUREMENTS FOR THORIUM LATTICES IN THE ECO REACTOR. Amoroso, F.; Broccoli, U.; Colombino, A.; Tosi, V.; Vigo, A. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Jan 1975. 74p. (In Italian). Dep. NTIS (US Sales Only) $6.75.

Buckling measurements for ThO_2-UO_2 fuel lattices in ECO reactor are presented. The substitution technique was used. The fuel elements were 19 and 37 rod clusters, with U-235 fissile material enriched to about 2.35%. The measurements were carried out with air, D_2O, H_2O and mixtures of D_2O-H_2O as coolant at four lattice pitches. An heterogeneous code was used to evaluate the experimental data. The measured values are compared with pure theoretical calculations. 14 references. (auth)

21539 (WANL-TME-1159) QUADRANT C HOT CAVE HANDLING EQUIPMENT FOR NASA EXPERIMENT 62-06. Summary Report. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jun 1965. Contract NAS3-5209. 39p. Dep. NTIS $5.00.

The design criteria, operational procedures and manufacturing specifications for the handling tools required by PBRF Experiment RFI 62-06 are described. The complete design package consists of the assembly and detail drawings listed in this summary report, and in the appendices under separate cover. The appendices are the manufacturing specifications. The functions to be carried out and the equipment designed are described in considerable detail. (auth)

21540 (WARD-LT-3045-1) SODIUM LEAK CHARACTERIZATION TESTS. Matheys, W. L. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Jun 1975. Contract E(11-1)-3405. 41p. AT.

A series of leak characterization tests was conducted to study sodium flow through pipe cracks and determine the minimum crack size for continuous leakage. Four tests were performed on two pre-cracked pipe specimens in a controlled environment simulating estimated FFTF inlet piping conditions. Leakage through the cracks was monitored at prototypic temperatures and pressures for a minimum of 150 hours in each test. Early testing showed that a small crack (~½-inch long) in a high moisture environment (6000 vppm H_2O) plugged at temperatures below 600°F, while a similar crack in a drier environment leaked continuously from 400°–800°F for 150 hours. In two extended tests of 500 hours at 800°F, both specimens plugged after a few hundred hours and did not reopen for the duration of testing. (auth)

21541 CHEMISTRY IN SODIUM COOLED NUCLEAR POWER PLANTS. Experiences in the Compact Sodium Cooled Nuclear Reactor Plant (KNK). Haubold, W. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bensberg/Koeln (F. R. Germany)); Stade, K. C. (Kernkraftwerk-Betriebsgesellschaft m.b.H., Leopoldshafen (F. R. Germany)); Stamm, H. H. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Radiochemie). VGB Kraftwerkstech.; 55: No. 2, 94-104(Feb 1975). (In German). 19 figs.; 5 tabs.; 13 refs.

Sodium as heat transfer medium in nuclear power plants, the plant systems of sodium cooled nuclear power plants, the behavior of structure and cladding tube materials in sodium, impurities of sodium and of the cover gas, the controlling of sodium and cover gas purity, and operational experience in the compact sodium cooled reactor plant are dealt with. (GE)

21542 DESIGN AND MANUFACTURE OF GAS TAGS FOR FFTF FUEL AND CONTROL ASSEMBLIES. Strand, C. A.; Schenter, R. E. (Westinghouse Hanford Co., Richland, WA). Nucl. Technol.; 26: No. 4, 472-479(Aug 1975).

The Fast Flux Test Facility being built near Richland, Washington, for materials and component testing for development of the liquid-metal fast breeder reactor will employ "gas tagging" for locating failed fuel and control elements in the Fast Test Reactor (FTR). The fuel and control pins are "gas tagged" by loading a capsule with specially blended krypton and xenon isotopes. The encapsulation of the tag gas employs a unique application of laser technology: stainless-steel capsules within a sealed glass-covered fixture containing the tag gas are first pierced and then seal welded with a laser beam. After inspection, the capsules are loaded in pins, and the gas is released by piercing the capsule with an electromagnetically activated internal penetrator. If the pin should develop a leak, the gas is released and the defect assembly is then located by mass spectrometric analysis of the reactor cover gas. Capsule filling yield for 40,000 capsules fabricated for 2 FTR cores was approximately 95 percent. 10 references. (auth)

21543 DESIGN OF PROTOTYPE CARBIDE SUBASSEMBLIES AND AN EVALUATION OF PROOF-TESTING PLANS IN THE FFTF. Vitti, J. A.; Doherty, P. K.; di Lauro, G. F.; Gilbertson, J. C.; Stuteville, D. W. (Combustion Engineering, Inc., Windsor, CT). Nucl. Technol.; 26: No. 4, 442-451(Aug 1975).

A preliminary assessment of proof testing 13 prototypical liquid-metal fast breeder reactor (LMFBR) carbide fuel assemblies in fast test reactor (FTR) driver positions leads to the conclusion that the testing plan is practical and should produce a large amount of data at operating conditions very similar to those that would be found in large commercial carbide-fueled LMFBRs. Three subassembly configurations were designed, each capable of being directly substituted into FTR driver positions and made compatible with the FTR geometry, fuel handling, power, temperature, subassembly flow rates, and pin-bundle pressure drop. Two sodium-bonded designs, one with 91 fuel pins with a 0.370-in. o.d. and the other with 127 fuel pins with a 0.315-in. o.d. per subassembly were established. Calculated peak linear power and peak discharge burnup slightly exceed present commercial design objectives of 30 kW/ft and 73 MWd/kg. Individual assembly power history, flux, and enrichments are represented quite well in the FTR for commercial outer-zone fuel assemblies. Inner-zone operating conditions, however, are not simulated as closely. Impact effects of the proof-test assemblies on FTR operation are judged to be manageable. 9 references. (auth)

Production and Materials Testing and Processing Reactors

Refer also to abstract 21453.

21544 (AAEC/E-331) MEASUREMENT OF SWIRLING FLOW IN HIFAR FUEL ELEMENTS AND THE EFFECTS OF FITTING FLOWSPLITTERS. Marshall, J. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Jan 1975. 37p. Dep. NTIS (US Sales Only) $5.00.

Measurements have been made of swirl in the coolant flow at the inlet of HIFAR fuel elements before and after flowsplitters were fitted in the inlet nozzles. There was considerable swirl before installation of the flowsplitters, and the amplitudes and directions of the swirl formed a symmetrical pattern over the core. The swirl activity distribution appears to have a definite relationship to positions in which some fuel element damage had been noticed. After flowsplitters were fitted, the swirl velocities were found to have been reduced by a factor of about twenty. (auth)

21545 (CEA-CONF-2989) HEAT FROM NUCLEAR SOURCES FOR INDUSTRIAL APPLICATIONS. Rastoin, J.; Gelin, P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service des Etudes Mecaniques et Thermiques). 1974. 12p (In English, French). INIS.

From 13th nuclear energy conference; Milan, Italy (12 Dec 1974).

The two great sectors of the industrial heat market are analyzed: low temperature up to 300°C and medium and high temperature over 300°C. In the first sector there are two dual purpose reactors, namely those that can produce both heat and electricity (PWR and HTR) and the heat producing reactors (BWR). In the medium and high temperature, reactors are well adapted. (FR)

21546 (DUN-3062) RADIOLOGICAL STATUS REPORT DEACTIVATION STATUS: D PLANT. Tatum, W. J. (Douglas United Nuclear, Inc., Richland, Wash. (USA)). 6 Oct 1967. Contract AT(45-1)-1857. 10p. Dep. NTIS $4.00.

The radiological status of deactivated buildings at the 100-D Area is described providing a record for use in post-deactivation surveillance and future salvage of material and equipment. (auth)

21547 (DUN-6664) K THROUGH REACTOR DECONTAMINATION ENGINEERING REPORT. Brinkman, L. B. (Douglas United Nuclear, Inc., Richland, Wash. (USA)). 21 Jan 1970. Contract AT(45-1)-1857. 7p. Dep. NTIS $4.00.

The basic engineering requirements for a through-reactor decontamination system at one of the K reactors are presented. (JWR)

21548 (DUN-7593) RADIOLOGICAL STATUS REPORT DEACTIVATION OF THE 105-B REACTOR PLANT. Westover, W. G. (Douglas United Nuclear, Inc., Richland, Wash. (USA)). 12 Apr 1971. 15p. Dep. NTIS $4.00.

The radiological status of deactivated buildings in 100-B Area associated with operation of 105-B is described providing a record for use in post-deactivation surveillance and salvage of material and equipment. It does not include surveys or conditions outside the concerned buildings. (auth)

21549 (DUN-7630) RADIOLOGICAL STATUS REPORT DEACTIVATION OF THE 105-KW REACTOR PLANT. (Douglas United Nuclear, Inc., Richland, Wash. (USA)). 26 Apr 1971. 14p. Dep. NTIS $4.00.

The 105-kW Reactor building and associated facilities were cleaned as necessary for long-range contamination and radiation control. Where complete release from radiation zone status was not practical, radiation zone posting was accomplished. Zones of significant contamination or radiation potential, including the Discharge Area, the Inner Rod Room, and the Ball 3X Tunnel, were barricaded to prevent inadvertent uncontrolled personnel entry. (auth)

21550 (DUN-7636) RADIOLOGICAL STATUS REPORT. Deactivation of the 105-KE Reactor Plant. Westover, W. G. (Douglas United Nuclear, Inc., Richland, Wash. (USA)). 30 Apr 1971. 18p. Dep. NTIS $4.00.

The radiological status of deactivated buildings in 100-K Area associated with operation of 105-KE as of April 15, 1971 is described providing a record for use in post-deactivation surveillance and salvage of material and equipment. It does not include surveys or conditions outside the concerned buildings. (auth)

21551 (GKSS-75/E/5) PROBLEMS OF SCALE FORMATION AND PREVENTION IN THERMAL SEA WATER DESALINATION. Froehner, K. R. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (F. R. Germany). Inst fuer Werkstofftechnologie). 1975. 29p. (In German). INIS.

10 figs.; 11 refs.

The wish to construct more efficient and more economical thermal sea water desalination plants collides with the problem of scale formation on the heating surfaces. A short survey of the chemical factors leading to scale formation is followed by a discussion of common descaling methods and other descaling methods which in spite of successful extensive tests have not been used in practice. Finally, the basic concept of a new method is discussed

which might have some advantages as compared to the conventional methods. (GE)

21552 (INIS-mf-1700, pp 62-73) FEASIBILITY OF A SINGLE-PURPOSE REACTOR PLANT FOR DISTRICT HEATING IN FINLAND. Tarjanne, R.; Vuori, A.; Eerikaeinen, L.; Saukkoriipi, L. 1974.

From nuclear heating and containments; Brno, Czechoslovakia (3 Oct 1973).

In nuclear heating and containment. Supplement. (Ceskoslovenska Komise pro Atomovou Energii, Prague).

A description is presented of a single-purpose PWR-type reactor with a thermal output of 100 (200) MW(t) designed for remote heating. It differs from common PWR reactors in that the electric power generating system is omitted, the steam generator is replaced by a water-water exchanger, and the primary cooling circuit operates at a lower temperature and a lower pressure of the coolant. Also described are the control system, core design, fuel costs, and the reactor safety safeguarding. Economic indices pertaining to the reactor are discussed. (INIS)

21553 COAL GASIFICATION UTILIZING HEAT FROM HIGH TEMPERATURE NUCLEAR REACTORS WITH SPECIAL CONSIDERATION OF THE ROLE OF THE REACTOR OUTLET TEMPERATURE. Juentgen, H.; van Heek, K. H. (Bergbau-Forschung G. m. b. H., Essen (F. R. Germany)). Kerntechnik; 17: No. 4, 181-187(Apr 1975). (In German, English).

6 figs.; 26 refs.

Using gas cooled high temperature nuclear reactors for the steam gasification of coal the fuel is converted into gas at optimum yield by supplying nuclear energy for the heat required in the process, especially for the endothermic water gas reaction and for steam generation. Compared with conventional gasification processes the coal consumption is reduced by about 40%, CO_2 emission by about 30% and the gas production costs, under German conditions, by about 25%. The present state of experimental and theoretical investigations shows that the technical and economic aspects of steam gasification of brown and bituminous coal at a reactor outlet temperature of 950°C are favourable, even taking into account a necessary intermediary circuit. If still higher outlet temperatures should become available, an increase efficiency of the whole plant and a division of the overall reactor power between gas and power generation according to demand would be possible. (auth)

21554 DEVELOPMENT OF HIGH-PERFORMANCE URANIUM-METAL FUELS FOR SAVANNAH RIVER REACTORS. McDonnell, W. R.; Sturcken, E. F. (E. I. du Pont de Nemours and Co., Aiken, SC). Nucl. Technol.; 26: No. 4, 420-429(Aug 1975).

The development of high-performance uranium-metal fuel elements for Savannah River reactors required a major metallurgical effort to achieve satisfactory irradiation behavior. Fuel-element design changes, principally embodying increased heat-transfer area, were accompanied by improved methods for bonding the uranium cores within aluminum cans. Anisotropic growth of the fuel element during irradiation caused by texture of the core was eliminated by development of beta heat-treating processes using oil quenching. Cavitational swelling was controlled by minor alloying additions to the uranium metal. The resulting fuel elements proved capable of sustaining high exposures. 18 references. (auth)

21555 MULTI-PURPOSE UTILIZATION OF NUCLEAR POWER AND THE DESALINATION AND REGIONAL COOLING AND HEATING. pp 200-281 of Survey on the Research of Multi-Purpose Nuclear Reactors, Vol. 1. Murata, H. (Japan Atomic Energy Research Inst., Tokyo); Yoda, Y.; Nozawa, M.; Ito, A.; Iwaki, T. (eds.). Tokyo, Japan; Fuji International Co. (1973). (In Japanese).

Reviewing the multi-purpose utilization of nuclear power, the following are described: (1) desalination of sea-water by nuclear-power — its role in the world background, water and electricity demands in Japan, system design of a nuclear desalination plant, and economy of the nuclear desalination; (2) regional cooling and heating by nuclear power — its background, simultaneous heat and electricity service, regional heating, and public line network. (JA)

21556 MULTI-PURPOSE UTILIZATION OF NUCLEAR POWER AND THE CHEMICAL INDUSTRY. pp 132-198 of Survey on the Research of Multi-Purpose Nuclear Reactors, Vol. 1. Murata, H. (Japan Atomic Energy Research Inst., Tokyo); Yoda, Y.; Nozawa, M.; Ito, A.; Iwaki, T. (eds.). Tokyo, Japan; Fuji International Co. (1973). (In Japanese).

Reviewing the multi-purpose utilization of nuclear power, the following are described: (1) energy demands in the chemical industry and the effect of energy conversion by nuclear power; (2) utilization of a multi-purpose light water reactor in the chemical industry — plans in BASF, Dow Chemical and Consumers Power for the use of electric power and steam, Nuclear Agro-Industrial Complex; (3) utilization of a multi-purpose high-temperature gas reactor in the chemical industry — plans in IGT, GGA-SAW Euratom, Jülich Institutes etc. for hydrogen production, gasification of coal and oil and so on. (JA)

Propulsion and Package Reactors

Refer also to abstracts 20210, 20307, 21457, 21539, 21671, 21672, and 21737.

21557 (AGC-2221) SCALE-MODEL HEAT-TRANSFER TEST OF THE NERVA NOZZLE. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jul 1962. Contract SNP-1. 125p. Dep. NTIS $9.25.

Declassified 11 Sep 1973.

A test program was conducted to obtain data on heat-transfer rates to a specific nozzle contour. For these tests $1/11$ and $1/4$ scale-model contoured nozzles were used with hot nitrogen gas as the working fluid. A thin-walled nozzle was used as the test device and was instrumented to obtain heat-transfer by measuring the wall temperatures as a function of time. An ejector duct was used to maintain full flow in the nozzle and two types of calorimeters were used to check the heat-transfer data. The test data were compared with several turbulent-flow boundary-layer calculations. No one correlation adequately predicted heat-transfer conditions throughout the nozzle, although the Colburn "j" equation, when modified to account for the three-dimensional flow distribution, was a reasonable representation of the test data. (auth)

21558 (AGC-2222) PRELIMINARY STRESS ANALYSIS NERVA HEATED-BLEED ENGINE. (Aerojet-General Corp., Sacramento, Calif. (USA)). May 1962. Contract SNP-1. 135p. Dep. NTIS $9.75.

Declassified 11 Sep 1973.

The highlights of the preliminary structural analysis of critical components, such as pressure vessel and nozzle assembly, core support structure, thrust structure, and roll control nozzles and actuators support structures are presented. In addition, a simplified dynamic analysis of the engine structure defines the need for rigidity requirements. Methods of analysis and assumptions utilized to confirm structural integrity are indicated in the various sections of the analysis. As more refined data is incorporated in future analyses, the method of analysis in all sections will become more rigorous, to insure obtaining a structure which will combine minimum weight with proper strength factors. (auth)

21559 (AGC-2278) INTERIM REPORT: NERVA ENGINE THERMODYNAMIC CYCLE SELECTION. (Aerojet-General Corp., Sacramento, Calif. (USA)). 23 Oct 1962. Contract SNP-1. 110p. Dep. NTIS $8.50.

Declassified 7 Sep 1973.

The performance, reliability and development problems of the heated-bleed and hot-bleed cycle NERVA nuclear rocket engines are compared. Although the heated-bleed engine has a slightly lower specific impulse than the hot-bleed engine, it is recommended by REON that the heated-bleed engine be the choice for development because of its inherently higher reliability. (auth)

21560 (AGC-2597) EVALUATION OF POST-OPERATIVE DESTRUCT SYSTEM CONCEPTS. (Aerojet-General Corp., Azusa, Calif. (USA)). 9 Aug 1963. Contract SNP-1. 198p. Dep. NTIS $13.00.

Declassified 11 Sep 1973.

Preliminary technical evaluations are presented of the explosive performance and the mechanical feasibility of the candidate NERVA Engine Explosive Destruct Systems, which are designed for use during or after the engine's operative period to ensure that no dangerous accumulation of radioactive particles falls on the Earth's surface. The Mark D concept (utilizing recoilless-type launchers, with follow-through, shaped-charge, projectile initiator charges) produced the best results of the numerous concepts investigated and also showed the best possibilities for use as an Anti-Criticality System. It indicated the most promise of achieving the destruct criteria as now tentatively established. The advantages of explosive techniques over other destruct concepts include: high specific energy, rapid reaction time, controllability, and reliability. The major problem encountered in explosives application for a post-operation destruct task is the complexity of the energy attenuation properties of the NERVA engine materials. The core pulverization achieved by an externally-placed explosive configuration is influenced by the massive, layered structure surrounding the core; while the performance of an internally-injected explosive is affected by the complex,

three-dimensional geometry of the fuel element material surrounding the explosive detonation centers. (auth)

21561 (AGC-8207-63-15) NRX-A ALUMINUM PRESSURE VESSEL S/N 0000002 HYDROSTATIC TEST STRUCTURAL EVALUATION REPORT. Cornell, A. D. (Aerojet Liquid Rocket Co., Sacramento, Calif. (USA)). 1 Oct 1963. 208p. Dep. NTIS $13.50.
Declassified 10 Sep 1973.
The results of the hydrostatic proof test of the NRX-A aluminum pressure vessel are reported. The test was successful in (1) demonstrating the ability of the pressure vessel to withstand a room temperature proof pressure of 645 psig, (2) providing information on flange deflections and rotations and stresses in areas computed to have minimum margins of safety, and (3) demonstrating the ability of the structural nozzle simulator to withstand a proof pressure of 485 psig. Experimental analysis revealed there was no yielding of the test assembly. (auth)

21562 (AI-AEC-Memo-12775) S8DR FUEL ROD FABRICATION. McClelland, D. T. (Atomics International Div., Canoga Park, Calif. (USA)). 29 Jan 1969. 43p. Dep. NTIS $5.25.
The S8DR core required 211 elements. Each S8DR fuel element contains a hydrided, enriched uranium fuel rod in an SCB-1 ceramic coated Hastelloy N tube and Hastelloy N end caps. The fuel rods were produced by triple consumable arc melting and double extrusion to achieve maximum homogeneity. The second extrusion formed the fuel rods which were then hydrided. The amount of hydrogen absorbed was controlled by the temperature and pressure in the retort. The hydrided fuel rods were inspected and those fuel rods which met composition requirements were final machined. A statistical analysis was performed on the processes and showed that they were capable of producing the S8DR fuel rods in a repeatable manner to an acceptable quality standard. The weight percent uranium for the entire core was 10.56 wt percent. The N_H was 6.07×10^{22} atoms of hydrogen per cubic centimeter of fuel and the carbon content was 0.15 wt percent. This compares well with the nominal values of 10.50 wt percent for uranium, 6.05 atoms of hydrogen per cubic centimeter of fuel for N_H, and 0.15 wt percent for the carbon. (auth)

21563 (LA-5931) REVIEW OF FUEL ELEMENT DEVELOPMENT FOR NUCLEAR ROCKET ENGINES. Taub, J. M. (Los Alamos Scientific Lab., N. Mex. (USA)). Jun 1975. 48p. Dep. NTIS $5.45.
The Los Alamos Scientific Laboratory (LASL) entered the nuclear propulsion field in 1955 and began work on all aspects of a nuclear propulsion program involving uranium-loaded graphite fuels, hydrogen propellant, and a target exhaust temperature of approximately 2500°C. A very extensive uranium-loaded graphite fuel element technology evolved from the program. Selection and composition of raw materials for the extrusion mix had to be coupled with heat treatment studies to give optimum element properties. The highly enriched uranium in the element was incorporated as UO_2, pyrocarbon-coated UC_2, or solid solution UC · ZrC particles. An extensive development program resulted in successful NbC or ZrC coatings on elements to withstand hydrogen corrosion at elevated temperatures. Hot gas, thermal shock, thermal stress, and NDT evaluation procedures were developed to monitor progress in preparation of elements with optimum properties. Final evaluation was made in reactor tests at NRDS. Aerojet-General, Westinghouse Astronuclear Laboratory, and the Oak Ridge Y-12 Plant of Union Carbide Nuclear Company entered the program in the early 1960's, and their activities paralleled those of LASL in fuel element development. (auth)

21564 (NAA-SR-Memo-7550) SNAP 10A SNAPSHOT PROGRAM DEVELOPMENT. (Atomics International Div., Canoga Park, Calif. (USA)). [nd]. 33p. Dep. NTIS $4.75.
The purpose of this document is to outline the ground rules for the component and system development program which will result in a flight SNAP 10A to meet the goals which have been set up for the SNAPSHOT program. From this development plan, a set of detailed component and system testing plans can be formulated. These detailed plans must then reflect all of the ground rules set forth in this section. (auth)

21565 (NAA-SR-Memo-9352(Rev. A)) SNAP 10A PRELAUNCH OPERATIONS NPU PRELAUNCH OPERATIONS-SPTF. (Atomics International Div., Canoga Park, Calif. (USA)). 19 Feb 1965. Contract AT(11-1)-GEN-8. 145p. Dep. NTIS $10.25.
The purpose of this manual is to provide information and procedures associated with the SNAP 10A prelaunch operations conducted at the SNAP Prelaunch Test Facility (SPTF), building 6527, located at Vandenberg Air Force Base (VAFB). Activities included in SPTF prelaunch operations begin upon receipt of the SNAP 10A system at the SPTF and conclude with shipment of the assembled SNAP 10A nuclear power unit (NPU) to the Point Arguello Launch Complex No. 2 (PALC-2). Each phase of the SPTF prelaunch operations program is concerned with preparing the NPU for launch. (auth)

21566 (NAA-SR-Memo-10234) SNAP 10A QUALIFICATION STATUS REPORT. Volume II. Component Development and Qualification Test Status, Structure. (Atomics International Div., Canoga Park, Calif. (USA)). 21 Sep 1964. Contract AT (11-1)-GEN-8. 60p. Dep. NTIS $6.00.
A description is presented of the SNAP 10A component development and qualification test status of the structure, including the conical structure, reactor support legs, reactor structure, instrument compartment, pump support structure, and ejectable heat shield. 11 references. (auth)

21567 (NAA-SR-Memo-11462) SNAPSHOT BRIEFINGS GIVEN AT VANDENBERG AIR FORCE BASE PRIOR TO LAUNCH. Heine, W. F. (Atomics International Div., Canoga Park, Calif. (USA)). 30 Jun 1965. Contract AT(11-1)-GEN-8. 48p. Dep. NTIS $5.50.

21568 (NAA-SR-Memo-11526) HIGH TEMPERATURE COIL DESIGN. Donelan, L. (Atomics International Div., Canoga Park, Calif. (USA)). 12 Jul 1965. 10p. Dep. NTIS $4.00.
Declassified 11 Dec 1968.
A considerable amount of information is available for the manufacture of coils made from standard materials. This information is extended for ceramic insulated coils for high temperature applications. This report contains general design parameters and allowances to be used in the design of ceramic insulated and encapsulated coils, capable of operating up to 1100°F in a vaccum. (auth)

21569 (NAA-SR-Memo-11574) EXPERIMENTAL STUDY OF INTRINSIC CORE SUBCRITICALITY BY NEUTRON SPECTRAL CHANGES. Clifford, D. W.; Yee, S. (Atomics International Div., Canoga Park, Calif. (USA)). 16 Aug 1965. 12p. Dep. NTIS $4.00.
Declassified 24 Jul 1974.
The SCA-4C and SCA-4B critical assemblies were used to measure the worth of gadolinium in and around the SCA-4 core in the operational and water-flooded configurations respectively. Gadolinium applied to the outer wall of the core vessel decreased the reactivity of the operational system by $2.44 while causing a $9.12 decrease in the fresh water immersion case. The maximum gadolinium concentration was $\Sigma_a t = 10.2$ with 90% of the worth being achieved with $\Sigma_a t$ of 2.5 in water and 6.0 dry. Gadolinium applied to the fuel claddings resulted in −$8.75 for $\Sigma_a t = 0.3$ in the operational configuration and −$10.65 for $\Sigma_a t = 0.2$ in fresh water. Substitution of sea water for fresh water resulted in a $2.05 reactivity loss and decreased the worth of $\Sigma_a t = 4.0$ on the core vessel from $8.57 to $6.79. 5 references. (auth)

21570 (NAA-SR-Memo-11825) SUMMARY OF ANALYSIS OF S8ER FISSION PRODUCT MONITORING. Miller, W. C.; Vollmer, R. H. (Atomics International Div., Canoga Park, Calif. (USA)). 21 Jan 1966. 12p. Dep. NTIS $4.00.
The significance of the measurements of fission products in the S8ER system from surge tank gas sample, primary coolant sample, and gamma monitor results is analyzed. 13 references. (auth)

21571 (NAA-SR-Memo-11889) EFFECT OF NaK ON AN ARTIFICIALLY RUPTURED S8ER FUEL ELEMENT. Engberg, C. J.; Neymark, R. S. (Atomics International Div., Canoga Park, Calif. (USA)). 23 Mar 1966. 23p. Dep. NTIS $4.25.
A developmental S8ER fuel element was annealed in a NaK thermal convection loop at approximately S8ER reactor coolant outlet temperature, 1280°F, and at a NaK pressure of 45 psia. The element was annealed for 145 hours with the cladding intact and for an additional 150 hours with a slit cut into the cladding. The average element temperature during the NaK anneal was 1180 ± 25°F. Operational uncertainties prevented an exact determination of the hydrogen loss rate from the element. Two methods were used to estimate the hydrogen loss rates of 7.6 and 12.5 cc/hr. These hydrogen loss rates are compared with those measured from two NaK bonded elements. The NaK bonded SCB coated element had a hydrogen loss rate at 1180°F isothermal of 11.5 cc/hr after 24 hours; whereas, the uncoated NaK bonded element had a rate of about 22 cc/hr. (auth)

21572 (NAA-SR-Memo-12088) EVALUATION OF IN-CORE INSTRUMENTATION FOR THE S8DS REACTOR, PHASE I. Goetz, C. A.; Donovan, E. J. (Atomics International Div., Canoga Park, Calif. (USA)). 1 Nov 1966. 114p. Dep. NTIS $8.75.
A comprehensive evaluation is made of in-core instrumentation for the SNAP 8 Developmental System (S8DS) reactor. The study encompasses compilation of desirable parameters for in-core

measurement, determination of measurement requirements, and comparison of these requirements with performance characteristics of candidate instruments. On the basis of selection criteria which include this comparison, recommendations are made for in-core and associated out-of-core instrumentation. The major in-core recommendation is the measurement of the coolant channel exit NaK temperature by means of chromel-alumel thermocouples suspended from a bridge installed above the outlet grid plate. (auth)

21573 (NAA-SR-Memo-12368) ELECTRON MICROSCOPY ANALYSIS OF IRRADIATED S8ER AND NAA 115-1 FUEL. Miller, K. J. (Atomics International Div., Canoga Park, Calif. (USA)). 7 Mar 1967. 57p. Dep. NTIS $6.00.

Based on the results of the S8ER detailed examination and the NAA 115-1 post-irradiation examination, selected fuel samples were chosen from regions of interest for electron microscopy to develop remote replication techniques at AIHL and to further characterize the fuel structure beyond that possible with optical metallography. Fuel samples were chosen from regions of large volume changes as characterized by peak distortions in the fuel rods and from regions of excessive hydrogen loss. Examination of the replica photographs revealed alpha uranium sites, carbide particle sites, phase boundaries, epsilon banding, and microcracks. Fission gas bubbles were observed in two S8ER samples from peak distortion areas and in all three NAA 115-1 samples examined. Bubble density measurements on the order of 10^{13} bubbles/cc were typical with an average bubble diameter of 900°A. The major contribution to fuel swelling in the S8ER fuel from peak distortion regions of the fuel rod was fission gas bubble formation. Fuel microcracking was observed in some samples, but was not as extensive as expected. Fission gas bubble formation was noted in all the NAA 115-1 fuel samples examined, but was not excessive. Apparent bubble depletion regions were observed around large particle sites and phase boundaries. This is thought to be a result of a gas bubble interaction region with the particle sites. Also, no correlation was observed of epsilon banding with the location of gas bubbles, particle sites, or microcracks. (auth)

21574 (NAA-SR-Memo-12379) TECHNIQUES FOR THE REMOTE REPLICATION OF IRRADIATED SNAP FUEL (ZIRCONIUM-10 W/O URANIUM ALLOY HYDRIDE). Krupp, W. E.; McAfee, D. D.; Johnson, L. L. (Atomics International Div., Canoga Park, Calif. (USA)). 7 Apr 1967. 14p. Dep. NTIS $4.00.

A convenient and reproducible method for the replication of irradiated SNAP fuel was developed. In-cell, samples were attack-polished with a HNO_3-HF-H_2O mixture and replicated with Faxfilm (cellulose acetate). Replicas were removed from the cell and decontaminated to allow handling in an uncontaminated area. Following shadowing with chromium and carbon to produce a secondary replica, examination in the electron microscope showed resolution of 300 Å. 4 references. (auth)

21575 (NAA-SR-Memo-12384) DETAILED THERMAL ANALYSIS OF SNAP REACTOR FUEL ELEMENTS INCLUDING ASYMMETRY AND SPACING EFFECTS. Magee, P. M. (Atomics International Div., Canoga Park, Calif. (USA)). 20 Mar 1967. 66p. Dep. NTIS $6.50.

The detailed heat transfer characteristics of fuel elements in the tightly packed (P/D = 1.018) SNAP 8 reactor core are analyzed. The two most significant parameters affecting temperature and heat flux distributions are the small (3.2 mil) radial gas gap between the fuel rod proper and the cladding and the close packing of the elements. Calculated average Nusselt numbers and convective heat transfer coefficients are approximately one-fourth those for flow in a circular tube of equivalent hydraulic diameter. The effects of element spacing, gap conductance, cladding thickness and fuel rod asymmetry within the cladding are investigated. 27 references. (auth)

21576 (RAR-652-340-002) PRELIMINARY FAILURE MODE AND EFFECT ANALYSIS. Addison, J. V. (Atomics International Div., Canoga Park, Calif. (USA)). 8 Sep 1972. 15p. Dep. NTIS $4.00.

A preliminary Failure Mode and Effect Analysis (FMEA) was made on the overall 5 Kwe system. A general discussion of the system and failure effect is given in addition to the tabulated FMEA and a primary block diagram of the system. (auth)

21577 (RAR-696-13-001) RELIABILITY ANALYSIS OF ZrH REACTOR THERMOELECTRIC SYSTEM. Burgess, D. S. (Atomics International Div., Canoga Park, Calif. (USA)). 29 May 1968. 17p. Dep. NTIS $4.00.

The reliability of the ZrH reactor thermoelectric system is determined on the basis of reasonably attainable component and subsystem estimates. The system reliability is presented for full and partial power and for both 10,000 hour and 20,000 hour missions. (auth)

21578 (RN-64010) EXPERIMENTAL AND ANALYTICAL STUDIES OF NUCLEAR EXHAUST SYSTEMS. (Aerojet-General Corp., Sacramento, Calif. (USA)). Aug 1964. Contract SNP-1. 56p. Dep. NTIS $6.00.

Scale model experimental results of the proposed NERVA nuclear exhaust system involving pumping the exhaust by means of a diffuser-ejector system are reported. The methods of correlating the results are not yet satisfactory: It appears that slight changes or side effects in the system have a larger effect on the system performance. Further work is necessary to resolve these problems before the performance of a large system can be predicted sufficiently accurately. Several problems are discussed in detail. (LTN)

21579 (RN-DR-0148) TECHNICAL AND PROGRAMMATIC REQUIREMENTS. (Aerojet-General Corp., Sacramento, Calif. (USA)). Feb 1968. Contract SNP-1. 43p. Dep. NTIS $5.25.

Declassified 10 Sep 1973.

Guidelines are suggested for the component development program, preliminary and formal qualification tests, and the provision of suitably qualified components for use in the guideline engine test program, reactor-assembly test program and special test assembly programs. Basically, the overall program requirements are established for the performance, design, development, test and scheduling of the NERVA propulsion system. (LTN)

21580 (RN-S-0026(Vol.1)) NERVA PROGRAM DESIGN REVIEW PRESENTATION TO SNPO ON 13-15 NOVEMBER 1963. Volume I. (Aerojet-General Corp., Azusa, Calif. (USA)). 30 Jan 1964. 215p. Dep. NTIS $13.75.

Declassified 7 Sep 1973.

The charts and texts of the NERVA design review presentation given to Space Nuclear Propulsion Office personnel on 13, 14, and 15 November 1963 by the Aerojet-General Corporation have been documented. (auth)

21581 (RN-S-0026(Vol.5)) NERVA PROGRAM DESIGN REVIEW PRESENTATION TO SNPO ON 13-15 NOVEMBER 1963. Volume V. (Aerojet-General Corp., Azusa, Calif. (USA)). 30 Jan 1964. 190p. Dep. NTIS $12.50.

The charts and texts of the NERVA design review presentation given to Space Nuclear Propulsion Office personnel on 13, 14, and 15 November 1963 by the Aerojet-General Corporation have been documented. (auth)

21582 (RN-S-0062) TPA PRESENTATION, SNPO-C. (Aerojet-General Corp., Azusa, Calif. (USA)). Feb 1964. 29p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

The performance of the NERVA turbopump assembly is indicated in a series of tables and graphs. (HDR)

21583 (RN-A-0072) STATUS REPORT FOR BI-FUNCTIONAL DESTRUCT SYSTEM. (Aerojet-General Corp., Azusa, Calif. (USA)). Apr 1964. Contract SNP-1. 81p. Dep. NTIS $7.25.

Declassified 10 Sep 1973.

Recommended design specifications and the results of initial design studies in evaluation of the Mark D bifunctional destruct system for application in the NERVA engine are described. In addition, a brief analysis of engine simulation and core fragmentation is presented plus an operational analysis of the anticriticality and postoperational destruct modes. (auth)

21584 (RN-S-0073) BENDIX TPCV ACTUATOR PRESENTATION. (Aerojet-General Corp., Azusa, Calif. (USA)). 19 Mar 1964. Contract SNP-1. 83p. Dep. NTIS $7.25.

Declassified 10 Sep 1973.

The Bendix Turbine Power Control Valve Actuator is described. Photographs and test results are included. (LJN)

21585 (RN-S-0074) MARK III TPA STABILITY ANALYSIS. (Aerojet-General Corp., Azusa, Calif. (USA)). 19 Mar 1964. Contract SNP-1. 24p. Dep. NTIS $4.25.

Declassified 10 Sep 1973.

The Los Alamos Scientific Laboratory concluded that the Mark III centrifical pumping system (with positive slope characteristics) would be unstable in operation. Aerojet employed a simulation of the engine as a pump load (which differed significantly from the simple load used by LASL) and, by calculational methods described, found the system to be stable to step disturbances when operating with closed control loops. Aerojet found instability using LASL's equations. Work to resolve the problem is continuing. (LTN)

21586 (RN-S-0134) PRELIMINARY REPORT ON NUCLEAR RADIATION HEATING OF COMPONENTS IN THE NERVA ENGINE.

(Aerojet-General Corp., Sacramento, Calif. (USA)). Apr 1965. Contract SNP-1. 107p. Dep. NTIS $8.50.

Declassified 7 Sep 1973.

Preliminary nuclear heating rates have been predicted for all components of the NERVA flight engine. Gamma ray heating was found to be from two to three decades higher than neutron heating but secondary gamma rays contributed as much as 50% of the total heating rate. These heating rate data were generated with the QAD code, a point kernel program. The uncertainty in these preliminary data varies from a low at ± 50% in the $\alpha = 90°$ direction to a high of a factor of 4 in the $\alpha = 0°$ direction. Additional work using the Monte Carlo approach to transport theory is recommended for those components whose design is limited by the heat generation rates quoted. (auth)

21587 (RN-S-0154) AEC-NASA SPACE NUCLEAR PROPULSION OFFICE PRELIMINARY ADVANCED ENGINE STUDIES (NERVA-II). (Aerojet-General Corp., Sacramento, Calif. (USA)). Dec 1964. Contract SNP-1. 127p. Dep. NTIS $9.50.

Declassified 10 Sep 1973.

The results of a study conducted to define the design and operational characteristics of an advanced nuclear rocket propulsion system, NERVA II, based on Phoebus II technology are described. The descriptive material, detailed in some areas and preliminary in others, is oriented toward the support of advanced engine and reactor studies. The NERVA-II engine configuration is based on the NERVA-I Hot Bleed Nuclear Rocket Engine concept. The systems descriptions and operational characteristics reflect flow and pressure schedule parameters established through the coordination of reactor and engine system constituents. Existing NERVA-I components and technology were utilized where possible. Significant changes were made in the thrust structure, gimbaling, and propellant feed system pressurization. The design utilizes an integrated reflector structure (combination of outer and inner reflector) and counter-flow tie tubes. (auth)

21588 (RN-S-0215) NRX-A2 NOZZLE-CHAMBER, TUNGSTEN-RHENIUM THERMOCOUPLES. (Aerojet-General Corp., Sacramento, Calif. (USA)). May 1965. 54p. Dep. NTIS $5.75.

Declassified 10 Sep 1973.

Four W-5% Re/W-26% Re thermocouples were used in NRX-A2 to measure nozzle chamber temperatures. Measured temperatures were analyzed from the Cal Comp data acquisition system and the Sanborn recorders. The performance of the thermocouples was examined and uncertainties in measured values were evaluated. A comparison of the measured temperature with temperatures evaluated indirectly was made. The design conditions were also compared with the measured and calculated chamber temperature of NRX-A2. No nuclear degradation was discernible. (auth)

21589 (RN-S-0220) ASSEMBLY AND BRAZING OF NERVA U-TUBE NOZZLES. (Aerojet-General Corp., Sacramento, Calif. (USA)). Oct 1965. 115p. Dep. NTIS $8.75.

Declassified 10 Sep 1975.

The development of assembly and furnace brazing procedures for NERVA regeneratively-cooled, hydrogen expansion nozzles using the "U" Tube design is described. Braze alloy selection, test program results, special tool designs and actual component assembly techniques are presented. The test program, using full length nozzle sections, qualified by hydro tests, and full scale hardware subjected to chemical and nuclear firings, indicates that, if appropriate assembly and furnace brazing procedures are used, satisfactory results can be obtained. (auth)

21590 (RN-S-0289A) XE-ENGINE SYSTEMS ANALYSIS DESIGN DATA BOOK. (Aerojet-General Corp., Sacramento, Calif. (USA)). Apr 1967. Contract SNP-1. 317p. Dep. NTIS $19.00.

Declassified 10 Sep 1973.

The Systems Analysis Design Data Book for the X-Engine system contains the component information used by the Systems Analysis personnel for input into the Steady-State and Transient Digital Computer Programs. General and detailed information pertaining to the philosophy and operation of the X-Engine is reported. Detailed information about the X-Engine model for input into the computer programs is organized as follows: component name, description, applicable drawings, component data, general mathematical equations, calculations, and references. General and detailed information pertaining to the test facility, and engine instrumentation is described. Finally, the equations developed by Westinghouse (Reactor) and Aerojet (Engine System) for the common analog model are discussed. (auth)

21591 (RN-S-0486(Vol.2)) XE-1 CAM EQUATION DERIVATION. (Aerojet Liquid Rocket Co., Sacramento, Calif. (USA)). Oct 1968. Contract SNP-1. 36p. Dep. NTIS $5.00.

Declassified 12 Sep 1973.

Five basic equations are used in the CAM XE-1 nuclear subsystem model with a detailed list of equations and constants that constitute the rest of the model. The five basic equations are: The conservation of mass, the conservation of momentum, the equation of state, the conservation of energy, and the conservation of neutron density. Each is discussed from a rather basic standpoint and the simplifications used to arrive at the CAM equations are described in detail. (auth)

21592 (SC-RR-72-0814) SHOCK RESPONSE OF DISTENDED CVD CARBON FELT. Lee, L. M. (Sandia Labs., Albuquerque, N. Mex. (USA)). Dec 1972. 61p. Dep. NTIS $6.25.

A study directed at determining the stress-wave propagation behavior in distended CVD carbon felt for use as heat shield material is described and the results presented. The primary objective was to experimentally investigate the shock response of the porous carbon felt and provide information defining the material's dynamic mechanical equation-of-state. The results from the shock experiments included Hugoniot and release adiabat data, attenuated wave profile measurements, and spallation data. The equation-of-state parameters necessary for shock attenuation calculations were provided by the Hugoniot and release data, making possible a critical comparison between the experimentally measured and calculated shock attenuation response. The calculated response was in good agreement with the attenuation data, both in wave shape and amplitude. Static confined compression experiments were conducted, in conjunction with ultrasonic measurements at load, to provide sound speed data during unloading. These data showed a marked variation in release velocity as a function of compaction state. The static samples were also evaluated for internal damage resulting from compression. The material damage was found to be minimal and localized to material surrounding the pores. (auth)

21593 (TI-759-240-031) FUEL ELEMENT VIBRATION STUDY: DESIGN AND ANALYSIS OF A PRE-KINKED COLUMN BUCKLING DEVICE. Anderson, R. V. (Atomics International Div., Canoga Park, Calif. (USA)). 3 Mar 1971. 44p. Dep. NTIS $5.50.

The column buckling device fuel element vibration suppressor has been analyzed and re-designed. Prekinking of the column shows resultant lowering of the strain hardening effects of a straight column and the axial deformation required to sustain the total column load. Design of the new CBD is presented and further recommendations are included. 24 references. (auth)

21594 (TID/SNA-1400) MECHANICAL IRRADIATION TEST 3/L002 TURBOPUMP BEARING SET. Final Test Report 1.9.5-5E. Young, F. E. (Aerojet Liquid Rocket Co,, Sacramento, Calif. (USA)). 20 Mar 1964. 56p. Dep. NTIS $6.00.

Nonlubricated, hydrogen-cooled ball and roller bearing assemblies were operated at cryogenic temperatures in a nuclear radiation field. The bearings are candidate NERVA turbopump bearing sets. Two sets of AGC PN 290102 roller bearings and one set of AGC PN 282919 ball bearings were tested. The bearings were in operation for five minutes at 24,000 rpm under radial and axial loads of 2000 lb. The bearing tester was exposed to integrated neutron fluxes ranging from 1.3×10^{12} to 5.2×10^{13} n/cm^2 (E > 2.9 MeV) and gamma doses ranging from 5×10^6 to 1.6×10^8 ergs/gm (C). The hydrogen coolant temperature increase of 120°F during the test attributed to gamma heating. A posttest visual examination showed no evidence of bearing degradation. (auth)

21595 (TID/SNA-1402) MATERIALS SELECTION FOR TASK 13 HOT-BLEED RADIATION-COOLED SKIRT APPLICATION, NERVA. Adair, S. E. (Aerojet Liquid Rocket Co., Sacramento, Calif. (USA)). 26 Dec 1961. Contract SNP-1. 15p. Dep. NTIS $4.00.

The expected operating parameters of the NERVA concept are used as a basis for a discussion of alloys, which are normally used at elevated temperatures, with respect to their use as NERVA skirt materials. Emphasis is placed upon refractory metal alloys, but nickel-, cobalt-, and titanium-base alloys are included. It is concluded that the requirements for the NERVA skirt material are most nearly fulfilled by TZM alloy (Mo-0.5 Ti-0.08 Zr), and that oxidation-resistant and emissivity-enhancing coatings are available. (auth)

21596 (TID/SNA-1404) STEADY STATE TEMPERATURE PROFILE OF NRX-A1 ALUMINUM PRESSURE VESSEL ASSEMBLY, REPORT NO. 9443-63-1. Thomas, E. A. (Aerojet Liquid Rocket Co., Sacramento, Calif. (USA)). 15 Apr 1964. Contract SNP-1. 30p. Dep. NTIS $4.50.

Thermal analyses of various critical locations of the NRX-A1 pressure vessel were made utilizing computer program 278C, a two dimensional finite difference thermal analysis program, with

the IBM 7094 digital computer. Heat input was assumed to be internal from nuclear heat generation. Heat generation rates for the pressure vessel shell aft of the forward dome were taken from Azusa Project Directive 38B. For sections of the forward dome operating with and without a shield values from PD 38B4 were used. Heat generation rates for the sections of the forward dome operating with a dummy shield were assumed to be triple the rates contained in PD 38B4 for operation with a shield. Cooling was assumed to be by conduction and convection. Thermal conductivity was made to vary with material temperature so that at each iteration the conductivity of each node was a function of the calculated temperature. Convective film coefficients were calculated using Thompson's "B" correlation with fluid conditions from the flow schematic contained in AGC No. 7386 in accordance with Azusa Project Directive 168. Based upon the results there is no excessive component heating. The analysis of the forward flange when operating under full reactor power with a dummy shield indicates no need for bolt cooling. (auth)

21597 (TID/SNA-1408) DESIGN OF A CRYOGENIC TWO POINT LIQUID LEVEL CONTROLLER. Henson, C. A. (Aerojet Liquid Rocket Co., Sacramento, Calif. (USA)). 10 Mar 1964. 36p. Dep. NTIS $5.00.

This cryogenic liquid level control system incorporates the high thermal sensitivity and resulting inverse change in resistance of commercial composition resistors at cryogenic temperatures to maintain (or monitor) the liquid level between an upper point (±1/2 inch) and a lower point (±1/8 inch). In general, the system includes two bridge circuits that govern the action of a control circuit for the cryogenic liquid supply valve. One bridge, having a carbon resistor sensor as one leg, is used for the lower level control. A similar bridge, also having a carbon resistor sensor as one leg, is used for the upper level control. In operation, the bridges are unbalanced when their respective carbon resistor sensors are immersed in the cryogenic liquid. The control circuit is then energized in accordance with the set point controls of two meter relays, one being connected across each bridge. Although the system depends upon the temperature of the resistor sensor, it does not depend solely upon the temperature difference between the liquid and the gas ullage. Considering the worst case, where the temperature of the gas is equal to or very near that of the liquid, the difference in self heating of the resistor sensor between gas and liquid immersion is sufficient to provide an operational signal to the control valve. The resistor sensor probe may be made compatible with a nuclear irradiation environment by selecting the appropriate irradiation resistant tube material for holding the resistor sensors and the appropriate insulation for the conductors to the resistors. (auth)

21598 (TID/SNA-1409) MECHANICAL IRRADIATION TEST 3/L003 TURBOPUMP BEARING SET. Young, F. E. (Aerojet Liquid Rocket Co., Sacramento, Calif. (USA)). 23 Apr 1964. 59p. Dep. NTIS $6.00.

Candidate NERVA turbopump bearing sets (nonlubricated, hydrogen-cooled roller- and ball-bearing assemblies) were operated at cryogenic temperatures in a nuclear radiation field. Two sets of roller bearings and one pair of ball bearings were tested. The roller bearing rollers, inner races, and outer races were made of Mod 440C steel; the cage material was polytetrafluoroethene laminated fabric. The ball bearing assemblies used Mod 440C (HTST) balls, inner races and outer races, and fluorinated ethylene propylene laminated fabric cages. The bearings were operated within a temperature range of −423 to −300°F at 24,000 rpm under 2000 lb radial and axial loads. The measured integrated neutron fluxes to which the bearing tester was exposed ranged from 1.9×10^{12} to 9.3×10^{13} n/cm² (E > 2.9 MeV). Measured gamma doses ranged from 5.8×10^{6} to 1.1×10^{8} ergs/gm(C). A posttest visual examination of the bearings showed no evidence of degradation. (auth)

21599 (TID/SNA-1411) NERVA GIMBAL DEVELOPMENT PROGRAM PLAN 9626-63-1. Wright, R. B. (Aerojet Liquid Rocket Co., Sacramento, Calif. (USA)). 15 Feb 1963. 11p. Dep. NTIS $4.00.

The development of a NERVA gimbal capable of operation during maximum thrust of the NERVA engine at altitude is described. The ability to carry the tensile load produced by the weight of the NERVA engine during the boost phase of operation is an additional requirement. A test program has been planned for structural testing of the NERVA gimbal in radiation and cryogenic environments. (auth)

21600 (TID/SNA-1412) ELECTRICAL IRRADIATION TEST 23/L501 PRESSURE TRANSDUCERS: FINAL TEST REPORT 1.9.5-2E. Volume II. Robb, T. C. (Aerojet Liquid Rocket Co., Sacramento, Calif. (USA)). 10 Apr 1964. 23p. Dep. NTIS $4.25.

One Dynisco, two Consolidated Electrodynamics Corp, seven Statham, and eight Gianinni pressure transducers were tested; eleven were irradiation tested, and seven were tested in a nonirradiation environment as control units. Neutron- and gamma-integrated doses were measured during the test, and transducer output voltages were recorded at intervals throughout the test. The low data accuracy of the data acquisition system precluded any qualitative analysis for effects of gamma heating and dose rates. No significant transducer material degradation was noted during the test. (auth)

21601 (TID/SNA-1414) ELECTRICAL IRRADIATION TEST No. 23/L001 PIEZOELECTRIC AND STRAIN GAGE-TYPE ACCELEROMETERS: FINAL TEST REPORT No. 1.9.5-2E. Volume I. Robb, T. C. (Aerojet Liquid Rocket Co., Sacramento, Calif. (USA)). Mar 1964. 24p. Dep. NTIS $4.25.

The effects of nuclear radiation on diagnostic instrumentation components intended for use of the NERVA engine were evaluated. Four Endevco, six Clevite, and one Kistler piezoelectric and six Statham strain gage-type accelerometers were tested on the Ground Test Reactor (GTR) for 100 hours. Accelerometers were vibrated during the test by shaker tables driven by air motors with unbalanced flywheels. Neutron and gamma integrated doses were measured during the test. Accelerometer outputs were recorded at intervals throughout the test. The accelerometers were not significantly affected by radiation during this test. (auth)

21602 (TID/SNA-1416) MECHANICAL IRRADIATION TEST NO. 1/L001 TANK SHUT-OFF VALVE, CONFIGURATION NO. 1. Volume II. Warner, M. H. (Aerojet Liquid Rocket Co., Sacramento, Calif. (USA)). Feb 1964. 45p. Dep. NTIS $5.25.

This test was designed to provide preliminary information as to the suitability of a first configuration NERVA Tank Shut-off Valve (TSOV) and its associated pilot valve and position indicator for operation in a combined cryogenic and radiation environment. The test was conducted on the Aerospace Test Reactor at General Dynamic's Nuclear Aerospace Research Facility in Fort Worth, Texas. The TSOV was immersed in low pressure liquid hydrogen and operated five times during the 327 second test while receiving an integrated dose of between 8×10^{12} to 9×10^{12} fast neutrons per cm² and a gamma dose of between 2.9×10^{7} and 4.0×10^{7} ergs per gram (carbon). From a comparison for pre- and post-irradiation test inspections, there was no apparent permanent deformation of the valve body or seat due to radiation effects and the valve seal was not functionally affected by the radiation received. (auth)

21603 (TID/SNA-1417) MECHANICAL IRRADIATION TEST NO. 4/L001. Volume III. Turbine Power Control Valve Configuration No. 1. Warner, M. H. (Aerojet Liquid Rocket Co., Sacramento, Calif. (USA)). Feb 1964. 43p. Dep. NTIS $5.25.

The objective of the NERVA Radiation Effects Test Program is to provide preliminary information of the effects of radiation on NERVA non-nuclear engine components under expected engine operating conditions. This test provided preliminary information as to the suitability of the NERVA Turbine Power Control Valve (TPCV) for operation in a radiation environment. The TPCV tested was designed for use in the heated bleed cycle engine. The irradiation test, which lasted for 327 seconds, was conducted on the Aerospace Systems Test Reactor (ASTR) at General Dynamics Corporation, Fort Worth, Texas. The valve body and disc were exposed to ambient GH_2 at a low flow rate and a low pressure (115 psig). The valve was cycled once each 60 seconds and received a total integrated fast neutron dose of from 1.1×10^{13} n/cm² (E > 2.9 MeV) and a gamma dose of from 3.8×10^{7} to 8.1×10^{7} ergs/g(c). The valve operating times were satisfactory and there was no apparent damage to valve, seat, or seals. (auth)

21604 (TID/SNA-1418(Vol.4)) MECHANICAL IRRADIATION TEST No. 8/L001, STATIC FLANGE SEAL ASSEMBLY. Final Test Report No. 1.9.5-1E, Volume 4. Warner, M. H. (Aerojet Liquid Rocket Co., Sacramento, Calif. (USA)). 16 Mar 1964. 41p. Dep. NTIS $5.25.

Mechanical Irradiation Test 8/L001 was designed to determine the effects of radiation on seals and flanges at LH_2 temperatures. Three combinations of stainless steel and aluminum flanges with aluminum or stainless steel gaskets were exposed to between 3.7×10^{13} and 9.0×10^{12} n/cm² of fast neutrons (E > 2.9 MeV) and a gamma radiation of from 1.3×10^{7} to 8.1×10^{7} ergs/gm(c). Temperature and pressure of the H_2 was monitored during the test, and leak checks and visual inspections were conducted during pre- and post-irradiation tests. No apparent damage to seals or flanges resulted from the irradiation test. There was an apparent change of bolt torque values on joints between pre- and post-irradiation tests accompanied by an increase in leak rate for the joints affected. This anomaly is not attributed to radiation effects. (auth)

21605 (TID/SNA-3025) KIWI-B TEST REPORT 9660-003. Wright, R. B. (Aerojet Liquid Rocket Co., Sacramento, Calif. (USA)). 31 Jan 1964. 39p. Dep. NTIS $5.00.

Declassified 12 Sep 1973.

A simulation firing was performed on Kiwi-B Nozzle, S/N 001K. During a very smooth start transient without abnormal pressure surges or signs of instability, the aluminum jacket failed at approximately 3.5 seconds. Pressure and flow values were approaching a steady state condition and failure was attributed to thermal shock combined with very low ductility of the aluminum jacket. To prevent nozzle failures of this type on future tests, it is imperative that the ductility of the aluminum jacket be improved without jeopardizing the yield strength of the casting. Because of the quality of the aluminum jacket, the test was made at a chamber pressure lower than design conditions. This resulted in lower density and less pressure drop available to obtain the required dump flow. To avoid this problem on future tests, the opening out of the adapter will be increased in size and the size of the dump line will be increased from 6 inches diameter to 8 inches diameter. Since the temperature rise in the nozzle varied from 41.8°F to 58.2°F when measured at three places 120° apart, additional probes will be installed on future tests to more accurately define temperature variations in the nozzle outlet manifold. Nozzle inlet pressures varied from 573.1 PSIG to 580.3 PSIG with the lowest pressure being measured at the fuel inlet. To help verify the condition of warmest nozzle outlet temperature being in line with the lowest nozzle inlet pressure, additional nozzle inlet pressure measurements will be made on future tests as well as additional inlet temperatures. The test duration of the one hot firing was too short for any valid evaluation of the heat transfer data; however, useful contact conductance values were obtained from the liquid nitrogen flow tests and are enclosed. (auth)

21606 (WANL-PR(J)-055) NERVA NUCLEAR SUBSYSTEM. Summary Progress Report, 1 October 1968–30 September 1969. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 24 Oct 1969. 163p. Dep. NTIS $11.25.

Declassified 11 Sep 1973.

The most significant event during the contract year was the successful testing of the XE Prime engine at ETS-1. The XE tests demonstrated that, (1) a nuclear engine can be started from various initial temperature and run tank pressure conditions without a nuclear flux control loop, (2) a nuclear engine can be started from various initial temperature conditions along the high specific impulse line to rated chamber temperature, and (3) a nuclear engine can be re-started many times over a wide range of engine preconditioning with or without a nuclear flux control loop. XE Prime was restarted over thirty times. Other significant results of the XE Prime tests were, (1) better understanding of reactor and engine dynamics during pre-conditioning, bootstrap, and shutdown, and (2) better understanding of reactor physics. The XE Backup was held under a nitrogen purge at E-MAD in the event it would be needed in the test program. Major nuclear, radiation, thermal, fluid flow, corrosion and structural analyses were performed as input to the systems trade studies. These trade studies included NSS throttling, NSS shielding, NSS startup and shutdown modes, NSS emergency requirements, turbine drive gas from the NSS, reactor control concepts study, nominal chamber temperature study, NSS cooldown requirements, NSS thrust nulling, NSS parametric performance evaluation. Conceptual and in certain cases intermediate analyses were performed in order to permit trade-offs between NSS reliability, weight and performance to be evaluated as part of these systems studies. Considerable effort was expended in evaluating the accuracy of nuclear and radiation design techniques against XE prime, PAX R-1, PHOEBUS II-A, and NRX experimental data. Drawings and preliminary specifications were produced to cover intermediate and high expansion fuel elements which are candidates for the R-1 reactor. The major emphasis is on development of high expansion fuel with the intermediate expansion fuel as a backup. Conceptual and design analysis was completed on three alternate reflector designs. Lateral support layouts were completed for each of the three alternate reflector concepts. Design and testing effort was performed in support of the pneumatic actuators utilized in the XE prime engine test. A series of experimental measurements were performed on the PAX R-1 critical assembly in direct support of the NERVA nuclear measurements including power distribution, control drum, and material reactivity coefficients. (auth)

21607 (WANL-PR(J)-056) NERVA NUCLEAR SUBSYSTEM. Progress Report, 1 October 1969–31 December 1969. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 25 Jan 1970. 151p. Dep. NTIS $10.75.

Declassified 11 Sep 1973.

During this reporting period revised NPRD requirements were established for a nuclear subsystem with a 10-hour endurance. A review of all trade studies was accomplished relative to the new requirement and new trade studies identified. A new reference design was configured for use in the 10-hour endurance reactor trade studies. Safety evaluations have indicated that it should be possible to complete an R-1 test without a facilities scrubber. However, an evaluation of the planned development program indicates that scrubbers will most probably be required in the facility. Preliminary evaluations were made relative to scrubbers applicable to Test Cell "C" and the possible requirements to test fire in a horizontal position. Reliability efforts resulted in the successful preparation and coordination in conjunction with AGC of the NERVA R-101 document. A system failure mode and criticality analysis for the hot bleed unit was completed, and a similar analysis for the new full flow cycle initiated. Also a system reliability model for the hot bleed unit was prepared and analysis completed in an attempt to apply reliability analysis to a graphite core reactor. In the technology program, post-operative disassembly of the XE actuators was monitored and actuator parts inspected for damage or wear. In the development program, the major Product Assurance efforts were in support of trade studies, materials properties data verification, and developing techniques and procedures for quality review and rating of designs in support of design engineering. (auth)

21608 (WANL-TME-018) RADIATION ENVIRONMENT AROUND SHIELDED AND UNSHIELDED KIWI B-1 REACTOR. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 25p. Dep. NTIS $4.25.

Declassified 14 Jul 1975.

The gamma radiation doses at different energies around a shielded and unshielded KIWI B-1 reactor are calculated for various distances and angles for different run times. (LTN)

21609 (WANL-TME-020) DOSE RATES FROM AN UNSHIELDED ENGINE. Ricks, L. O. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 6 Mar 1962. 4p. Dep. NTIS $10.00.

Declassified 14 Jul 1975.

The radiation dose rate ten feet from an unshielded Phoebus engine 24 hours after shutdown from three 20 minute runs has been calculated. A graph shows the relative dose rate, in three energy groups, for decay times up to 30 days. These data were requested by Aerojet General Corporation for comparison with the dose rates from an unshielded core. Values for a NERVA engine may be obtained by multiplying the tabulated values by the power ratio of the two engines. The analysis for the engine radiation levels was performed in 8 gamma energy groups using the computer shielding program 14-0. It includes only radiation from the decay of fission products in the core, the activity due to component activation being negligible. The data for the 8 energy groups were reduced to three equivalent groups and a curve drawn to show the change in the dose rate contribution for each of the 3 groups for decay times from 24 hours to 30 days. (auth)

21610 (WANL-TME-190) B6 REACTOR MEETING AT WANL ON NOVEMBER 7 AND 8, 1962. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 12 Nov 1962. 5p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

A meeting discussion on B6 reactor design involved reactor materials, certain reactor components, reactor start-up problems and after-heat removal. (LTN)

21611 (WANL-TME-213) RESIDUAL ACTIVITY OF TEST CELL A COMPLEX AFTER AN NRX TEST. Ricks, L. O. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 19 Nov 1962. 1p. Dep. NTIS $4.00.

Declassified 14 Jul 1975.

It is estimated that the radiation dose rate at test cell A from activation of the wall, concrete pad, rails, etc. at one month after a 20 minute full power NRX run will be between 6 and 40 min/hr. Since less than 30 man hours of labor will be required in the pad area before the next test, it is concluded that test cell activation will probably not necessitate stringent operating limitations. (LTN)

21612 (WANL-TME-257) THERMOCOUPLE, RESISTANCE THERMOMETER AND STRAIN GAGE TRANSDUCER DEVELOPMENT PLANS AND CANDIDATE TRANSDUCER DATA SHEETS FOR INCLUSION INTO NERVA INSTRUMENTATION DATA BOOK. Ramp, R. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 19 Jan 1963. 19p. Dep. NTIS $4.00.

A preliminary description of the development planned for thermocouples, resistance thermometers and strain gages intended for use in NRX-A and E-1 engine tests is presented. Also included are the data sheets relating to these candidate transducer instruments. (auth)

21613 (WANL-TME-567) EVALUATION OF THREE CANDIDATE CLUSTER PLATE MATERIALS. Filippi, A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 18 Oct 1963. 33p. Dep. NTIS $4.75.

Declassified 14 Jul 1975.

The mechanical properties of three nuclear control materials were evaluated for cluster plate applications. The alloys studied were: 80Ag–15In–5Cd, 75.6Ag–11.5In–8.6Cd–4.4Sn, and 1% boron stainless. Annealed 80Ag–15In–5Cd plate displayed an unusually high yield strength which approached that of the tin-containing alloy. The increased yield strength is thought to be a result of the type of fabrication employed and a relatively fine final grain size. The strength of 80Ag–15In–5Cd can be greatly increased through cold work (approximately 50% reduction in thickness), and recrystallization will not occur in 50 hours at 760°R. Material in this condition does, however, rapidly recrystallize at slightly higher temperatures so silver-base alloys can hardly be considered for any structural engineering use at temperatures above 800°R because of appreciable loss of strength. The strength, ductility and notch properties of 1% boron-containing stainless steel remain relatively high at test temperatures between 140°R and 1500°R. Because of this, the alloy is considered the only one of the three candidate materials definitely adequate for cluster plate application. The possibility of irradiation-induced property change in these alloys was also evaluated. None of the three candidate materials will be seriously affected by the NERVA radiation environment. (auth)

21614 (WANL-TME-574(Rev.1)) NUCLEAR DATA LIBRARY FOR THE FISSION PRODUCT PROGRAM. Trammell, M. R.; Henniger, W. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 17 Nov 1966. 52p. Dep. NTIS $5.75.

The Table of Nuclear Data includes the atomic number and chemical symbol, mass number, half-life, decay constant, fission yield, beta-spectrum, and gamma-spectrum of each nuclide. (auth)

21615 (WANL-TME-679(Pt.2)) GADOLINIUM–STAINLESS STEEL DEVELOPMENT. Part II. Begley, J. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 7 Feb 1964. 43p. Dep. NTIS $5.25.

Declassified 14 Jul 1975.

Fabrication procedures were developed to produce AISI 304 stainless steel + 1 w/o Gd_2O_3 strip for neutron absorbing cluster plates. Large powder compacts were directly hot rolled to finish gage. Evaluation showed that hot rolled, annealed material meets the mechanical property requirements for cluster plates over the desired temperature range of –160°F to 1000°F. Although the notched tensile properties in the transverse direction are low, they are considered adequate. Cold worked material exhibited improved notched properties, but marginal ductility at room temperature and above render this material unsuitable. Prohibitive radiation damage is not expected at the flux environment of cluster plates for a 20-minute NERVA hot test. A problem with chemical homogeneity has only recently been solved. Test results are given. (auth)

21616 (WANL-TME-804) NRX-A2 ACTIVATION ANALYSIS REPORT. Stephenson, L. D.; Planinsek, F. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1964. 133p. Dep. NTIS $9.75.

Declassified 10 Sep 1973.

Gamma source strengths and estimates of dose rate from NRX-A2 reactor components are presented. The data are given as a function of time after reactor operation and have as their basis a single period of reactor operation with 1.77×10^5 megawatt seconds of integrated power. The data may be applied to other similar reactor operating schedules by multiplying by the ratio of the new integrated power level to 1.77×10^5 megawatt seconds. An operating schedule which includes a restart may be treated as two independent periods of operation. The source strength data include both fission product gamma sources and sources due to the gamma emission from radioactive nuclei in reactor materials. (auth)

21617 (WANL-TME-1100) NRX-A3 ELEMENT PLACEMENT AND ORIFICING SUMMARY REPORT. Phillips, R. B. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 19 Feb 1965. 70p. Dep. NTIS $6.50.

Declassified 14 Jul 1975.

A tabulation of pertinent core data for the NRX-A3 reactor build has been prepared which describes the physical location of fuel elements, nuclear shimming, instrumentation and number and sizes of orifices for the as-built core. A summary of the thermal characteristics of each fueled element in its individual location is presented. (auth)

21618 (WANL-TME-1240) CALIBRATION OF INSTRUMENTED LATERAL SUPPORT SPRINGS AND TIE RODS FOR NRX-A4 (EST). Sucevic, J. M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1965. 26p. Dep. NTIS $4.50.

Declassified 12 Sep 1973.

A total of seventeen instrumented lateral support springs and six tie rods were calibrated prior to assembly of the NRX-A4(EST) reactor. The instrumentation consisted of Microdot weldable strain gages mounted on both the leaf springs and tie rods. Strain versus deflection data was obtained for the leaf springs and strain versus load data was obtained for the tie rods at ambient and cryogenic temperatures. Apparent strain data was obtained for both components under load and no-load conditions. It was noted, prior to calibration of the leaf springs, that several of the welded tabs which held the sheath cable to the leaf spring had broken welds. In the process of calibration, it was noted that the springs with the majority of the welds broken had lower than normal output. A special test of the effect of broken tab welds on the calibration was conducted which showed that, with three of the six welds broken, a drop in output of 45% from the original calibration occurred. As a result of this information, the welds were removed on one side of each tab. This reduced the possibility of tab weld failure and consequent calibration error. The calibrations were repeated following these modifications. The calibration of tie rods showed that the load-strain curves had excellent linearity; that is, they were always within 2% of a straight line. Apparent strain calibrations were obtained on tie rods, under load, at temperatures of +400°F. The apparent strain was only slightly affected by load; that is, the change due to load was less than 0.6% of the full scale strain output of the gage (strain due to 550 lb load). The individual tie rod strains compared closely with one another; all fell within a range of 17% of the strain output due to a 550 lb load. The calibrations showed that if the output of the tie rod gages were not corrected for temperature effects, the error would increase with decreasing load. For example, the error would be 15% of the strain output at a 550 lb load, while at 100 lb the temperature effect would amount to as much as 80%. Two tie rods were rejected due to a failure in the sheath cable, causing a short in one case and an open circuit in another. These tie rod gages were repaired and recalibrated. The important effects seen during the calibrations and proof tests are summarized. (auth)

21619 (WANL-TME-1267) POWER PERTURBATIONS IN COUPLED REACTOR SYSTEMS. Mowery, A. L.; Romesburg, H. C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1965. 15p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

For large, NERVA II type reactors in a close-coupled system, the perturbation of the normal power distribution can be significant. The present study was undertaken to estimate the magnitude of the power tilting in coupled systems of NERVA II reactors. The analysis is based on two premises: The maximum tilting displayed by a coupled system may be reasonably represented by a slab geometry, inhomogeneous transport model; and tilting is linear with shutdown. The results lend support to the first assumption and LASL data substantiates the second to the extent that linear interpolation should be conservative. Close-coupled NERVA I and NERVA II systems would have reactivity couplings of about 45¢ and 10¢, respectively, if two reactors were operating with their pressure vessels in contact. This is the maximum coupling that could be expected for present designs. Peripheral power perturbations for this case would be a maximum of 16 percent for NERVA I and 10 percent for NERVA II. At the expected array separation of 33 feet, the reactivity coupling is about 0.8¢ for NERVA I and 0.3¢ for NERVA II. For this array, the power perturbation would be quite negligible (less than one percent). An array of three or more reactors will, of course, lead to greater power perturbations. Presuming a linear aximuthal variation of power from the maximum (toward a reactor in the array) to the minimum, this problem can be handled in an approximate fashion by superposition. The basic degree of tilting can be estimated from the amount of coupling and the geometry of the array will dictate the superposition procedure. (auth)

21620 (WANL-TME-2005) ENGINEERING CRITICAL COMPONENT SPECIFICATION, PART 1. Performance/Design and Qualification Requirements. Cluster Hot End Support Hardware for NERVA Nuclear Subsystem. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 May 1968. 16p. Dep. NTIS $4.00.

Declassified 14 Jul 1975.

The requirements for performance, design, test and qualification of the group of components identified as the Cluster Hot End Support Hardware (CHESH) are established. This group includes those components which transfer the load from the fueled and unfueled elements to the support stem at the hot end of the core. (auth)

21621 (WANL-TME-2011) ENGINEERING CRITICAL COMPONENT SPECIFICATION, PART I. Performance/Design and Qualification Requirements. Lateral Support System for NERVA Nuclear Subsystem. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 May 1968. 16p. Dep. NTIS $4.00.

Declassified 14 Jul 1975.

The requirements for performance, design, test and qualification of the group of components identified as the Lateral Support System (LSS) are established. This group includes: load and/or seal rings, loading plungers, springs, spring caps, and thermal insulation. (auth)

21622 (WANL-TME-2012) ENGINEERING CRITICAL COMPONENT SPECIFICATION PART I. Performance/Design and Qualification Requirements. Core Periphery for NERVA Nuclear Subsystem. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 May 1968. 16p. Dep. NTIS $4.00.

Declassified 14 May 1968.

The requirements for performance, design, test and qualification of the group of components identified as the Core Periphery are established. This group includes filler strips and insulation. (auth)

21623 SIXTH SPACE CONGRESS, SPACE, TECHNOLOGY, AND SOCIETY, COCOA BEACH, FLORIDA, MARCH 17-19, 1969. Jones, L. E. III (comp. and ed.). Cape Canaveral, FL; Canaveral Council of Technical Societies (1973). vpp. (CONF-690355-P1).

From 6th space congress on space, technology and society; Cocoa Beach, Florida, USA (17 Mar 1969).

A separate abstract was prepared for the one paper which is inside the scope of NSA. (JWR)

For an abstract of an individual paper see: 21624.

21624 NERVA: CONTRIBUTING TODAY AND TOMORROW. Ledbetter, D. L. (Aerojet-General Corp., Sacramento, CA). pp 2.7-2.14 of Sixth Space Congress, Space, Technology, and Society. Jones, L. E. III (comp. and ed.). Cape Canaveral, FL; Canaveral Council of Technical Societies (1973).

From 6th space congress on space, technology and society; Cocoa Beach, Florida, USA (17 Mar 1969). See CONF-690355-P1.

The year 1968 has seen accomplishment of important goals in the technology development phase of the NERVA program, including demonstration of the capability of the nuclear reactor to operate for 60 minutes at full-rated power, proving the ability of the system and components to meet specifications. Based on the success of the technology development program, conceptual studies and designs leading to selection of the configuration for flight application were initiated. From this complex R & D program a promise has come of many new and important technological developments. As various areas of research were opened to prove the feasibility of nuclear rocket propulsion, many conventional techniques required modification, due to the unique environment of the nuclear rocket. Some of the significant technology now in use by the nonspace community that was originally developed by the engine contractor for the NERVA program will be described. Further, an extrapolation of some other technology areas currently being investigated and a suggestion of potential applications beyond those obvious in the earlier discussion will be presented. (auth)

Reactor Safety and Environmental Aspects

Refer also to abstracts 19709, 19710, 19732, 19736, 19759, 19773, and 21753.

21625 (AECL-5060) REWETTING OF A HOT SURFACE. Thompson, T. S. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Apr 1975. 8p. (CONF-740925-9). Dep. NTIS (US Sales Only) $4.00. AECL $0.20.

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974).

The rewetting of a hot cladding surface following various anomalous nuclear reactor operating situations is governed by two-dimensional conduction in the cladding wall. A correlation in the form of the approximate analytical solution to the two-dimensional conduction problem is suitable for predicting the rewetting velocity, i.e., $1/v = \rho c(T_2 - T_c)/\phi_{eff}$. The physical basis of this equation is explained and arguments are presented based on more exact analysis as to why wall thickness, wall thermal conductivity, rod diameter, heat generation rate, and coolant flow rate are not included. (auth)

21626 (AED-CONF-75-119-001) ON THE QUESTION OF CLIMATE CHANGES BY THE OPERATION OF POWER PLANTS. Caspar, J. W. (Deutscher Wetterdienst-Zentralamt, Offenbach am Main (F. R. Germany)). 1975. 9p. (In German). INIS.

From fair and special meeting on environmental protection; Frankfurt, F. R. Germany (22 Apr 1975).

5 figs.; 1 tab. Available from ZAED.

Meteorological problems of river or sea water cooling, the problem of meteorological changes due to cooling tower operation, the importance of the atmospheric conditions for a possible climatic change through cooling towers and siting problems are discussed. (GE)

21627 (ANCR-1219) CONTEMPT-LT: A COMPUTER PROGRAM FOR PREDICTING CONTAINMENT PRESSURE-TEMPERATURE RESPONSE TO A LOSS-OF-COOLANT ACCIDENT. Wheat, L. L.; Wagner, R. J.; Niederauer, G. F.; Obenchain, C. F. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). Jun 1975. 231p. Dep. NTIS $7.60.

CONTEMPT-LT is a digital computer program, written in FORTRAN IV, developed to describe the long-term behavior of water-cooled nuclear reactor containment systems subjected to postulated loss-of-coolant accident (LOCA) conditions. The program calculates the time variation of compartment pressures, temperatures, mass and energy inventories, heat structure temperature distributions, and energy exchange with adjacent compartments. The program is capable of describing the effects of leakage on containment response. Models are provided to describe fan cooler and cooling spray engineered safety systems. Up to four compartments can be modeled with CONTEMPT-LT, and any compartment except the reactor system may have both a liquid pool region and an air-vapor atmosphere region above the pool. Each region is assumed to have a uniform temperature, but the temperatures of the two regions may be different. CONTEMPT-LT can be used to model all current boiling water reactor pressure suppression systems, including containments with either vertical or horizontal vent systems. CONTEMPT-LT can also be used to model pressurized water reactor dry containments, subatmospheric containments, and dual volume containments with an annulus region, and can be used to describe containment responses in experimental containment systems. The program user defines which compartments are used, specifies input mass and energy additions, defines heat structure and leakage systems, and describes the time advancement and output control. CONTEMPT-LT source decks are available in double precision extended-binary-coded-decimal-interchange-code (EBCDIC) versions. Sample problems have been run on the IBM-360/75 computer. (auth)

21628 (ANL-75-31) PHYSICS OF REACTOR SAFETY. Quarterly Report, January–March 1975. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-Eng-38. 33p. Dep. NTIS $4.00.

Progress in reactor safety research and technical coordination of the RSR safety analysis program by members of the Reactor Safety Appraisals Group, Applied Physics Division, Argonne National Laboratory, for January-March 1975 is reported. Pump coastdown calculations have been carried out for an improved model of the CRBR, with results similar to previous ones. A mild initial disassembly is obtained, but there is a remote possibility of a more severe one from failure of low-power pins in the presence of sodium. The PLUTO code has been applied to this problem. Pump coastdown calculations have been carried out for a model of a 4000 MW(e) oxide-fueled LMFBR similar to one studied by P. Bleiweis et al. Pump rates from sodium voiding are only $10-20/sec instead of up to $250/sec reported by Bleiweis. Physics calculations have been carried out for the equilibrium fuel cycle for the CRBR. A model of a boiling pool of liquid fuel and steel has been developed and embodied in the POOL code. Neutronics are furnished by the FX-2 space-time kinetics code. Meetings have been held with representatives of BNL to discuss their Super System Code Development and with representatives of LASL to discuss the SIMMER code and related work at ANL, including POOL. The status of nuclear data relevant to safety calculations has been reviewed. A preliminary experimental program plan for core meltdown simulation experiments on ZPR's is presented. The status of an analytical study of ZPR-3 Assembly 27 is reported. (auth)

21629 (BNWL-B-417) MODELS FOR PREDICTING THE REMOVAL OF AIRBORNE CONTAMINANTS BY REACTOR CONTAINMENT SPRAYS. Postma, A. K.; Ritzman, R. L.; Gieseke, J. A.; Schmidt, E. W. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 27 Jun 1975. Contract AT(45-1)-1830. 122p. Dep. NTIS $5.45.

Mathematical models for spray removal of methyl iodide and aerosol particles, as well as a model for deposition of elemental

iodine on wall surfaces have been deduced from available experimental and theoretical information. The models were chosen to yield conservative estimates of fission product removal under postulated accident conditions in water reactors. Important results from this study include the following. Wall deposition of elemental iodine is limited by gas phase mass transfer resistance, and the rate of deposition may be predicted using a mass transfer model which describes transport through a thermally convected boundary layer. The wall deposition rate is small compared to spray washout and is important primarily because it permits total washout to be computed as a sum of wall sorption and spray washout. Methyl iodide absorption is a case of absorption with simultaneous chemical reaction, and may be predicted from models based on stagnant drops and wall films. Due to its comparative inertness, the removal rate constant for CH_3I by aqueous sprays is less than 1 hr^{-1}. Particle removal was predicted using the HAA-3B, modified to account for spray washout. Studies of the particle source term for a meltdown accident indicated that some 9 percent of fission products would become airborne. Primary particles of diameter 0.02 to 0.1 mum would grow by agglomeration in the primary vessel to sizes of 0.8 to 4 mum depending on accident conditions. Relatively rapid removal of particles by the spray is predicted, leading to a 2 hr DRF of the order of 9. (auth)

21630 (CONF-691114-8) STEAM SURGE TANK TRANSIENTS DURING OUTSURGE. Gorman, D. J. (Atomic Energy of Canada Ltd., Chalk River, Ontario). 1969. 6p. American Society of Mechanical Engineers, New York, NY $1.50.

From 90th annual meeting on american society of mechanical engineers; Los Angeles, California, USA (16 Nov 1969).

Testing of the theoretical model's ability to predict pressure behavior during outsurge from an actual reactor surge tank at operating pressures and given surge rates, with some variation in the range of levels and pressures used is discussed. Demonstrating the closed isentropic expansion model's inadequacy, achievement of very good agreement between experiment and theory based on the proposed model is shown. Although it would be possible to take heat flow from the vessel walls into consideration, the results obtained indicate that such a complication of the analysis is not warranted. If outsurges were to occur over longer periods of time, the effect of heat inflow could be much more significant. For surge tank systems of the type described here, it is concluded that the theoretical model predicts transients with good accuracy. (auth)

21631 (CONF-750418-3) RELIABILITY MODELING OF CLINCH RIVER BREEDER REACTOR ELECTRICAL SHUTDOWN SYSTEMS. Schatz, R. A.; Duetsch, K. L. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). 1974. 28p. Dep. NTIS $4.50.

From sixth annual conference on modeling and simulation; Pittsburgh, Pennsylvania, USA (24 Apr 1975).

The initial simulation of the probabilistic properties of the Clinch River Breeder Reactor Plant (CRBRP) electrical shutdown systems is described. A model of the reliability (and availability) of the systems is presented utilizing Success State and continuous-time, discrete state Markov modeling techniques as significant elements of an overall reliability assessment process capable of demonstrating the achievement of program goals. This model is examined for its sensitivity to safe/unsafe failure rates, subsystem redundant configurations, test and repair intervals, monitoring by reactor operators; and the control exercised over system reliability by design modifications and the selection of system operating characteristics. (auth)

21632 (CONF-750468-1) DECAY HEAT REMOVAL FOR THE LIQUID METAL FAST BREEDER REACTOR. Zemanick, P. P.; Brown, N. W. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). 1975. 62p. Dep. NTIS $6.25.

From specialist meeting on reliability of decay heat removal systems proposed for fast reactors; Harwell, UK (28 Apr 1975).

The functional and reliability requirements of the decay heat removal systems are described. The reliability requirement and its rationale as adequate assurance that public health and safety are safeguarded are presented. The means by which the reliability of the decay heat removal systems are established to meet their requirement are identified. The heat removal systems and their operating characteristics are described. The discussion includes the overflow heat removal service and its role in decay heat removal if needed. The details of the systems are described to demonstrate the elements of redundancy and diversity in the systems design. The quantitative reliability assessment is presented, including the reliability model, the most important assumptions on which the analysis is based, sources of failure data, and the preliminary numerical results. Finally, the qualitative analyses and administrative controls will be discussed which ensure reliability attainment in design, fabrication, and operation, including minimization of common mode failures. A component test program is planned to provide reliability data on selected critical heat removal system equipment. This test plan is described including a definition of the test parameters of greatest interest and the motivation for the test article selection. A long range plan is also in place to collect plant operational data and the broad outlines of this plan are described. A statement of the high reliability of the Clinch River Breeder reactor Plant decay heat removal systems and a summary of the supporting arguments is presented. (auth)

21633 (CONF-750804-3) HEAT TRANSFER AND FRICTION CORRELATIONS REQUIRED TO DESCRIBE STEAM-WATER BEHAVIOR IN NUCLEAR SAFETY STUDIES. Solbrig, C. W.; McFadden, J. H.; Lyczkowski, R. W.; Hughes, E. D. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). 1975. 107p. Dep. NTIS $8.50.

From conference on heat transfer; San Francisco, California, USA (11 Aug 1975).

The description of two-phase flow is important in nuclear safety studies. Recent two-phase flow descriptions are based upon unequal phase velocities and unequal phase temperatures (UVUT) theories with interphase interaction terms. These theories are more mechanistic than homogeneous theories and require more and different types of correlations than homogeneous theories. The UVUT theories require correlations (or models) which describe wall and interphase mass transfer, friction, momentum transfer, and heat transfer for all flow regimes and heat transfer regimes. A set of correlations is presented in this paper which can be used with UVUT theories. These correlations cover the complete range of parameters needed and in all cases are expected to yield reasonable numbers. (auth)

21634 (CONF-750804-4) PIPE BLOWDOWN ANALYSIS USING EXPLICIT NUMERICAL SCHEMES. Lyczkowski, R. W.; Grimesey, R. A.; Solbrig, C. W. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). 1974. 46p. Dep. NTIS $5.50.

From conference on heat transfer; San Francisco, California, USA (11 Aug 1975).

Several explicit numerical schemes were investigated to solve the homogeneous equations of change for one-dimensional fluid flow and heat transfer. The most successful technique investigated is the alternating gradient method which is based on the two-step Lax-Wendroff procedure. Agreement with experimental results is very good. (auth)

21635 (CONF-750804-5) PARTIAL FLOW BLOCKAGE EFFECTS WITHIN A (LIQUID METAL COOLED FAST REACTOR) LMFBR FUEL ASSEMBLY. Bishop, A. A.; Engel, F. C.; Markley, R. A. (Pittsburgh Univ., Pa. (USA). Dept. of Chemical Engineering; Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). 1975. Contract AT(11-1)-2395. 38p. Dep. NTIS $5.00.

From conference on heat transfer; San Francisco, California, USA (11 Aug 1975).

A lumped thermal-hydraulic model was used to calculate the increase in the sodium and cladding temperatures in the wake behind a non-porous partial flow blockage within a typical LMFBR fuel rod assembly. The model predicts that over 25 percent of the cross sectional flow area may be blocked before the wake fluid temperature reaches boiling; the actual size depends on the blockage axial location and radial location. Agreement with the limited sodium flow rod bundle blockage data is achieved by the model if the wide variation observed in the experimental cladding temperatures within the wake region is attributed to variations in local heat transfer coefficients. (29 references) (auth)

21636 (CONF-750804-9) MEASUREMENTS OF VELOCITIES DOWNSTREAM OF BLOCKED SUBCHANNELS IN A MODEL REACTOR ROD BUNDLE. Vegter, B. J.; Roidt, R. M.; Pechersky M. J.; Markley, R. A. (Westinghouse Research Labs., Pittsburgh, Pa. (USA)). 30 Dec 1974. 37p. Dep. NTIS $5.00.

From Conference on heat transfer; San Francisco, California, USA (11 Aug 1975).

Two blockage configurations were installed on the upstream end of a hexagonal grid in an 11:1 scale 39 rod bundle air model of a liquid metal fast breeder reactor. Velocities were measured in subchannels behind and adjoining the blockages. The region of separated flow was found to be five times a characteristic height of the blockages, consistent with other experimental results. The effect of the grids on the length of separated flow was minimal. Flow rates in subchannels centered downstream of the blockages recovered to 90 percent of the upstream flow rates in the 28 rod diameter length between grids. 3 references. (auth)

21637 (COO-2571-1) IMPROVEMENT AND VERIFICATION OF FAST REACTOR SAFETY ANALYSIS TECHNIQUES. Pro-

gress Report, March 1, 1975–May 31, 1975. Jackson, J. F. (Brigham Young Univ., Provo, Utah (USA). Dept. of Chemical Engineering). 1975. Contract AT(11-1)-2571. 7p. Dep. NTIS $4.00.

The initial steps required in establishing a linkup between BYU and the CDC-7600 computer at Lawrence Berkeley have been taken. The linkup should be completed during the next quarter. The first phase of the VENUS-II/PAD comparison study has been accomplished via the comparison of two representative excursions in a demo-sized LMFBR. A calculation that provides the work-energy obtained from an isentropic expansion of fuel-vapor down to one atmosphere has been included in VENUS-II. A technique to provide the full P-V-work curve as a function of the degree of expansion is currently under development. Previous comparisons between disassembly codes and experiments have been reviewed and an initial model for analyzing the KIWI-TNT experiment with VENUS-II is being formulated. (auth)

21638 (DUN-3898) B REACTOR DEACTIVATION ENGINEERING REPORT. Brinkman, L. B. (Douglas United Nuclear, Inc., Richland, Wash. (USA)). 29 Feb 1968. Contract AT(45-1)-1857. 9p. Dep. NTIS $4.00.

Pursuant to the decision of the Atomic Energy Commission to deactivate the B Reactor, engineering studies were initiated to determine the scope of work required to effect the shutdown of B Reactor and its associated support facilities and systems, and to effect optimization of those facilities and systems in 100-B Area required to continue in operation in support of the C Reactor. Recommendations to the deactivation group responsible for implementing the deactivation activities are presented. (auth)

21639 (FRNC-TH-519) INTERPRETATION OF EXPLOSIVE PHENOMENA IN NUCLEAR REACTORS. Le Berre, F. (Aix-Marseille-1 Univ., 13 - Marseille (France)). 1974. 138p. (In French). INIS.

A film boiling model revealed, during experimental studies on CABRI, the existence of water hammer effects, i.e., sudden meetings of the channel water with the fuel plate, which could explain the explosive initiation of a reactor core when an absorbent rod is ejected (SPERT accident 1). A comparison of theoretical and experimental results obtained on the reaction CABRI is very satisfactory. A good fit is obtained between the calculated power curves and the theoretical curves. The model thus offers a means to determine the energies released by power excursions. (FR)

21640 (GA-A-13258) METALLIC FISSION PRODUCT RELEASE FROM THE HTGR CORE. Alberstein, D.; Smith, P. D.; Haire, M. J. (General Atomic Co., San Diego, Calif. (USA)). 15 May 1975. (GA-LTR-20).

The methods used to calculate metallic fission product direct release from the High-Temperature Gas-Cooled Reactor (HTGR) core are presented. The transport process for metallic fission products and the sequential steps in their release are discussed. Assumptions used to model the transport process are given, and a summary description of the design methods currently in use is presented. Release calculations for strontium-90 are given as an example of the methods employed, and sensitivity to changes in the input data is discussed. (auth)

21641 (GA-A-13280) GCR SAFETY PROGRAM. Quarterly Progress Report for the Period October 1, 1974–December 31, 1974. (General Atomic Co., San Diego, Calif. (USA)). 14 Feb 1975. Contract AT(04-3)-167. 43p. Dep. NTIS $4.00.

Information is presented concerning seismic effects on control rods and reserve shutdown system, HTGR accident initiation and progression analysis, component and system reliability data bank for HTGR and GCFR, and HTGR safety research on containment of core-released radioactivity and containment flammability during postulated accident situations. (DCC)

21642 (GA-A-13300) EVALUATION OF ALTERNATIVE SHUTDOWN-SYSTEMS CONCEPTS FOR THE GAS-COOLED FAST BREEDER REACTOR. Antonsen, K.; Cauble, G. L. (General Atomic Co., San Diego, Calif. (USA)). 7 May 1975. Contract AT(04-3)-167. 33p. Dep. NTIS $4.00.

Several existing breeder and thermal reactor shutdown systems, such as those for the LMFBR and HTGR and some new variations, were reviewed and evaluated for potential application to the Gas-Cooled Fast Breeder Reactor (GCFR), with diversity from the GCFR reference control-rod drive system and reliability as the main objectives. (auth)

21643 (GEAP-14023-2) SAFETY ASSESSMENT SECOND PROGRESS REPORT, SEPTEMBER–NOVEMBER 1974. (General Electric Co., Sunnyvale, Calif. (USA). Breeder Reactor Dept.). 1974. Contract AT(04-3)-893. 63p. AT.

The objective of the work reported is to establish procedure and techniques, such as probabilistic methodology, for quantitative assessments of LMFBR safety. Progress during September, October and November 1974 is described for tasks related to LMFBR Risk Assessment Methods and Probabilistic Pipebreak. (auth)

21644 (GKSS-75/E/6) MAN, ENERGY, AND ENVIRONMENT. Bagge, E. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (F. R. Germany)). 1975. 10p. (In German). INIS.

From HEA-fall meeting; Wiesbaden, F. R. Germany (25 Oct 1974).

15 figs.; 1 tab.; 12 refs.

In the present work an introduction is given on the coal, oil and energy demand of mankind, and the emissions due to coal and oil combustion are dealt with. Nuclear energy is then introduced as a new energy source, the nuclear fuel supplies are estimated and the radiation and environmental impact of nuclear power plants is discussed. Furthermore, the possibility of nuclear accidents and the role of the atomic waste is dealt with. Finally, prognoses are made on the future development. (GE)

21645 (HEDL-TME-74-47(Vol.2)) MELT-III: A NEUTRONICS, THERMAL-HYDRAULICS COMPUTER PROGRAM FOR FAST REACTOR SAFETY ANALYSIS. Volume II. Waltar, A. E.; Partain, W. L.; Kolesar, D. C.; O'Dell, L. D.; Padilla, A. Jr.; Sonnichsen, J. C.; Wilburn, N. P.; Willenberg, H. J. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Dec 1974. Contract AT(45-1)-2170. 265p. Dep. NTIS $13.60.

A program listing for the MELT-III code is presented. (JWR)

21646 (HEDL-TME-75-9) MICROSTRUCTURAL DEPENDENCE OF FAILURE THRESHOLD IN MIXED OXIDE LMFBR FUEL PINS. Scott, J. H.; Baars, R. E.; Culley, G. E.; Hunter, C. W. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Oct 1974. Contract AT(45-1)-2170. 101p. AT.

The design and licensing of Liquid Metal Fast Breeder Reactors (LMFBR) requires an extensive and basic understanding of fuel pin response to a wide variety of off-normal events. Such events range from anticipated mild off-normal conditions to very severe, purely hypothetical conditions, for which no realistic initiating mechanism can be identified. The response of the fuel pin to one class of such postulated events, the hypothetical transient overpower accident, is described. (auth)

21647 (NP-20418, pp 63-84) OVERVIEW OF SEISMIC DESIGN MARGINS. Newmark, N. M. May 1975.

In program report, Reactor licensing. (Atomic Industrial Forum, Inc., New York (USA)).

Topics discussed include general procedures for earthquake resistant design, earthquake hazards at sites, structural resistance parameters, probability of exceeding design levels, and probability of occurrence of design earthquake. (JWR)

21648 (NP-20418, pp 85-92) SELECTION OF SAFE SHUTDOWN EARTHQUAKES. Denton, H. R. May 1975.

In program report, Reactor licensing. (Atomic Industrial Forum, Inc., New York (USA)).

The regulatory staff criteria and procedures for evaluating the design basis for vibratory ground motion and selecting the safe shutdown earthquake are discussed. (JWR)

21649 (NP-20418, pp 93-101) EFFECTS OF FOUNDATION CONDITIONS ON PLANT DESIGN. Ehasz, J. L. May 1975.

In program report, Reactor licensing. (Atomic Industrial Forum, Inc., New York (USA)).

Design considerations for nuclear plant foundations are examined including site stability, bearing capacity and settlement, dynamic response, and structural modeling techniques for dynamic analysis. (JWR)

21650 (NP-20418, pp 102-118) EVALUATION OF SEISMIC DESIGN OF NUCLEAR POWER PLANTS. Zar, M. May 1975.

In program report, Reactor licensing. (Atomic Industrial forum, Inc., New York (USA)).

The seismic loading, the structural modeling, and the methods of analysis used in evaluating the seismic design of nuclear power plants are examined. (JWR)

21651 (NP-20418, pp 119-122) SEISMIC MARGINS AS THEY EFFECT THE VERIFICATION OF SEISMIC DESIGN ADEQUANCY OF MECHANICAL AND ELECTRICAL COMPONENTS. Stevenson, J. D. May 1975.

In program report, Reactor licensing. (Atomic Industrial Forum, Inc., New York (USA)).

Seismic design requirements and procedures which bear on the overall safety margin associated with safety class mechanical and electrical components used in nuclear power plants are reviewed. (JWR)

21652 (NP-20418, pp 130-136) DETERMINATION OF CONDITIONS FOR DESIGN FOR NUCLEAR POWER PLANTS. Gilbert, W. D. May 1975.

In program report. Reactor licensing. (Atomic Industrial Forum, Inc., New York (USA)).

Progress toward the development of comprehensive and uniform method for establishing safety criteria for the design of nuclear power plants is surveyed. (JWR)

21653 (NP-20418, pp 137-139) VIEWPOINT ON ANTICIPATED TRANSIENTS WITHOUT SCRAM. Gangloff, W. C. May 1975.

In program report. Reactor licensing. (Atomic Industrial Forum, Inc., New York (USA)).

The current situation regarding the treatment of anticipated transients without scram in nuclear power plant design is discussed. (JWR)

21654 (NP-20418, pp 140-144) REACTOR VESSEL INTEGRITY. Mallay, J. F. May 1975.

In program report. Reactor licensing. (Atomic Industrial Forum, Inc., New York (USA)).

Some observations on the bases supporting the non-credibility of reactor vessel failure are presented. (JWR)

21655 (NP-20418, pp 145-149) ACCIDENT DOSE CALCULATION METHODS. Willoughby, N. B. May 1975.

In program report. Reactor licensing. (Atomic Industrial Forum, Inc., New York (USA)).

The conservatisms used in the models for calculating the radiological doses following a reactor accident are discussed. (JWR)

21656 (NP-20418, pp 150-159) OVERVIEW OF THE REACTOR SAFETY STUDY. Levine, S. May 1975.

In program report. Reactor licensing. (Atomic Industrial Forum, Inc., New York (USA)).

A brief review of the Rasmussen Reactor Safety Study is presented. Some of the comments received concerning the first draft of the study are discussed. (JWR)

21657 (NP-20418, pp 160-161) REACTOR SAFETY STUDY, AN INDUSTRY VIEW. Corcoran, W. R. May 1975.

In program report. Reactor licensing. (Atomic Industrial Forum, Inc., New York (USA)).

Possible effects of the Rasmussen Reactor Safety Study on the nuclear industry are discussed. (JWR)

21658 (NP-20418, pp 162-168) FAULT TREE AND EVENT TREE ANALYSIS: AN APPRAISAL. Erdmann, R. C. May 1975.

In program report. Reactor licensing. (Atomic Industrial Forum, Inc., New York (USA)).

The value of fault tree and event tree analysis in reactor safety evaluations is discussed. (JWR)

21659 (NP-20505) ANNUAL REPORT, 1974. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (F. R. Germany)). 1975. 110p. (In German). Dep. NTIS (US Sales Only) $8.50.

The primary operations of the Institute for Reactor Safety are briefly reviewed. These include information services, regulating the production and transport of radioactive materials, assistance in the design of systems and components and determination of operating conditions for nuclear installations, licensing operations, the work of the Reactor Safety Commission, and commissioning of the Radiation Protection Commission. The reports and publications from the IRS and lectures given by its members are compiled. (JSR)

21660 (NP-20516) SAFETY-TECHNICAL RESEARCH PROGRAM: CONDENSATION AND FREE-BLOWING RESEARCH. Final Report. Sobottka, H. (comp.). (Kraftwerk Union A. G., Erlangen (F. R. Germany). Reaktortechnik). Jun 1975. 90p. (In German). Dep. NTIS (US Sales Only) $7.50.

At the Mannheim power station and at a model test stand at Grosswelzheim investigations were made concerning development and improvement of a nozzle system for the condensation of steam in a water pool, to achieve a structural component load as low as possible at the instationary start (free-blowing) and a soft condensation at the quasistationary process. Different types of perforated tubes were tested as well as several nozzle types. (auth)

21661 (ORNL-NSIC-122) ANNOTATED BIBLIOGRAPHY OF SAFETY-RELATED OCCURRENCES IN NUCLEAR POWER PLANS AS REPORTED IN 1974. Scott, R. L.; Gallaher, R. B. (Oak Ridge National Lab., Tenn. (USA)). May 1975. Contract W-7405-eng-26. vpp. Dep. NTIS $15.00.

All abnormal occurrences at nuclear power plants reported in 1974 are reviewed and summarized. This bibliography covers the individual reports on each of the 1421 abnormal occurrences reported to the U. S. Nuclear Regulatory Commission, as well as some 455 other documents pertaining to these and other events of note. The review is intended to provide insight as to where additional effort can be expended to improve operations in nuclear power plants. The individual reports, abstracted by the Nuclear Safety Information Center, concern incidents and failures, design or construction deficiencies, and noncompliance citations for license violations. A bibliography is included which contains 100-word abstracts of each incident. For convenience, the bibliography is organized according to type of facility as follows: boiling-water reactors; pressurized-water reactors; non-water-cooled power reactors; and reactors, general. Keyword and permuted-title indexes are provided for each section. (auth)

21662 (ORNL-TM-4914(Vol.3)) QUARTERLY PROGRESS REPORT ON REACTOR SAFETY PROGRAMS SPONSORED BY THE NRC DIVISION OF REACTOR SAFETY RESEARCH FOR JANUARY-MARCH 1975. Vol: Liquid-Metal-Cooled Fast Breeder Reactor Safety. Fontana, M. H.; Kress, T. S. (Oak Ridge National Lab., Tenn. (USA)). Jul 1975. Contract W-7405-eng-26. 56p. Dep. NTIS $5.45.

Progress in the investigation of the release and behavior of fuel, fission products, and transuranic elements in aerosols resulting from an LMFBR hypothetical core disruptive accident (HCDA) is reported. The development and test results of a capacitor discharge vaporization (CDV) technique for simulating HCDA conditions in LMFBR fuel are described. A program to assess the performance of reactor vessel liners during massive sodium spills and sodium sprays and jets is outlined. (DCC)

21663 (ORNL-TM-4950) MONTHLY HIGHLIGHTS FOR OFFICE OF NUCLEAR REGULATORY RESEARCH PROGRAMS AT OAK RIDGE NATIONAL LABORATORY. Fee, G. G. (comp.). (Oak Ridge National Lab., Tenn. (USA)). Apr 1975. Contract W-7405-eng-26. 42p. Dep. NTIS $5.25.

Summaries are given of the following programs: heavy section steel technology, fission product beta and gamma energy release, LOCA release from LWR fuel, multirod burst tests, Nuclear Safety Information Center, PWR blowdown heat transfer-separate effects, Zircaloy fuel cladding collapse studies, Zr metal-water oxidation kinetics, transient vaporization of LMFBR fuel, and HTGR safety analysis and research. Technical highlights and cost/budget reports are included. (DLC)

21664 (RAND-P-5413) RELIABILITY REVIEW OF THE REACTOR SAFETY STUDY. Kamins, M. (Rand Corp., Santa Monica, Calif. (USA)). Apr 1975. 27p.

Deficiencies in the Rasmussen Reactor Safety Study (WASH-1400) are pointed out. These deficiencies involve the use of a discredited methodology and the incorrect use of that methodology. (JWR)

21665 (RD/B/N-3262) STUDY OF THE CONDENSATION OF VAPOUR JET INJECTED INTO SUBCOOLED LIQUID POOLS. Greef, C. P. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Mar 1975. 16p. Dep. NTIS (US Sales Only) $4.00.

In the development of certain hypothetical fast reactor faults, bulk sodium boiling may occur in a subassembly with the formation of a vapour jet injected from the subassembly into the above core plenum. The acoustic properties of the vapour jet determine the possibility of detecting this stage of the incident by monitoring the boiling noise produced. In order to examine the phenomenon, measurements have been made of the physical processes occurring when vapour jets are injected into subcooled liquid pools using Freon 113 and water as working fluids. The results demonstrate the significance of sonic choking of the vapour flow in determining the mode of condensation; the regular release of discrete bubbles from the jet, characteristic of lower flow rates, ceases when the flow chokes and a steady conical vapour jet results. (auth)

21666 (TID-26826) EXPERIMENTAL INVESTIGATION OF THE FRAGMENTATION OF MOLTEN METALS IN WATER. Bjorkquist, G. M. (Energy Research and Development Administration, Oak Ridge, Tenn. (USA). Technical Information Center). Jun 1975. 81p. Dep. NTIS $5.45.

Small amounts of molten tin and bismuth were dropped into water to investigate the fragmentation of molten metals. The major parameter of the experimental program was the initial drop temperature but drop mass and drop material were also varied. The pressure signal of the interaction was recorded, high speed motion pictures of the interaction were made, and the metallic debris was collected. The experiments and analysis were patterned after and were intended to be a continuation of work done by Trond Bjornard. Several important additions were

made to the experimental apparatus. Specifically they were a hotter furnace to allow a greater range of initial drop temperature, provision of an argon atmosphere during the melting and dropping of the metal sample to prevent excessive oxidation at high temperatures, and modification of the tape recorder to allow a longer time interval to be recorded. An attempt was made to interpret the dwell time in terms of the cooling of the molten drop. Calculations show that, in the case of tin, drops with an initial temperature greater than 600°C will cool to a temperature in the vicinity of 600°C before fragmenting. (auth)

21667 (TID-26827) THERMAL STRESS INITIATED FRACTURE AS A FRAGMENTATION MECHANISM IN THE UO_2–SODIUM FUEL-COOLANT INTERACTION. Knapp, R. B. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering). May 1975. 201p. Dep. NTIS $7.60.

An analytic study was carried out to determine the applicability of the concept of thermal stress fragmentation to the UO_2/sodium Fuel-Coolant Interaction. Major emphasis was put on the fracture mechanics approach to assessing whether or not the solidifying UO_2 would fracture under the thermally induced stresses. It was found that the stress levels were sufficient to generate K/sub I/ values substantially in excess of the UO_2 fracture toughness, K/sub IC/. Thus, rapid instantaneous propagation of inherent flaws is anticipated. Parametric studies in which the surface heat transfer boundary condition was varied did not alter this conclusion. Extension of the thermal stress fracture concept to Al_2O_3 resulted in similar behavior. Subsequently, this material was selected as a good simulant for use in experimental studies of the mechanism. Additional studies on time led to the conclusion that thermal stress fracture was not an applicable mode of fragmentation inducement in ductile metal/water interactions. It was concluded that thermal stress fragmentation is a feasible mode of fragmentation in the UO_2/sodium system. However, further experimental and analytical work is necessary to establish firm verification of this model. (auth)

21668 (UCLA-34P203-2) DRY OUT OF A FLUIDIZED PARTICLE BED WITH INTERNAL HEAT GENERATION. Keowen, R. S.; Catton, I. (California Univ., Los Angeles (USA). Dept. of Energy and Kinetics). Mar 1975. Contract AT(04-3)PA203. 59p. (UCLA-24P223-2; UCLA-ENG-7519). Dep. NTIS $6.00.

An apparatus was designed to adequately simulate the characteristics of a particle bed formed by nuclear reactor fuel after the reactor has been operable for some length of time at high power. This was accomplished by using a 10 KW, 453 Kc induction heater, coupled through a multi-turn work coil to particle beds of cast steel shot and lead shot in water. The temperature response and dryout condition was determined for various bed levels, particle diameters, and heat fluxes. Analysis of the data retrieved from the bed was used to generate a family of curves to predict the necessary conditions for dryout to occur within a fluidized particle bed with internal heat generation. The results presented here, with internal heat generation, show that previous results with bottom heating and volume heating are conservative. (auth)

21669 (UCLA-34P223X1) SAFETY CONSIDERATIONS OF COMMERCIAL LIQUID METAL FAST BREEDER REACTORS. Progress Report, 15 June 1974–1 December 1974. Kastenberg, W. E.; Catton, I. (California Univ., Los Angeles (USA)). 1974. Contract AT(04-3)-34. 15p. Dep. NTIS $4.00.

Research progress during the period is reported for the following tasks: (1) transient behavior of fuel elements; (2) accident analysis; (3) post accident heat removal; (4) fuel-coolant interactions; and (5) thermodynamic considerations. (JWR)

21670 (UCLA-34P223X2) SAFETY CONSIDERATIONS OF COMMERCIAL LIQUID METAL FAST BREEDER REACTORS. Progress Report for the Period January 1, 1975–March 31, 1975. Kastenberg, W. E.; Catton, I. (California Univ., Los Angeles (USA)). 1975. Contract AT(04-3)-34. 16p. Dep. NTIS $4.00.

Research progress during the period is reported for the following tasks: (1) transient behavior of fuel elements; (2) accident analysis; (3) post accident heat removal; (4) fuel-coolant interactions; and (5) thermodynamic considerations. (JWR)

21671 (WANL-TME-1126(Suppl.2)(Rev.1)) NRX/EST SAFETY EVALUATION REPORT. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 20 Nov 1965. 25p. Dep. NTIS $4.25.

21672 (WANL-TME-1126(Suppl.3)) NRX/EST SAFETY EVALUATION REPORT. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 27 Dec 1965. 29p. Dep. NTIS $4.50.

This supplement to the NRX/EST-SER was prepared to supply additional information on several of the facility systems and EST components and as a safety review of the Bootstrap Startup Test planned for NRX/EST-EP-II. The PCV-41 coolant system to be used during NRX/EST engine testing in the event of LH_2 flow shutdown and the chamber pressure schedule that will be implemented for EP-II for LH_2 flow following a scram have been included. A review of the nuclear instrumentation used for reactor startup and of the nuclear safety systems is presented to support a proposed plan to delay the Post-Test Criticality Measurements beyond the run-day of the various Experimental Plans. A brief description of the test and operations to be conducted during EP-II is contained in Section 3. A safety analysis and the consequences of malfunctions of the EST system for EP-II operation is given in Section 4. Accidental control drum runouts, control drum insertion, flow malfunction, and PCV-41 failures have been discussed. It is concluded that the EP-II Test Operations can be conducted as planned without undue risk of abnormal fission product release or danger to personnel. (auth)

21673 (WCAP-8355(Supp.1)) LONG TERM ICE CONDENSER CONTAINMENT CODE: LOTIC CODE. Hsieh, T.; Ramund, M. (Westinghouse Nuclear Energy Systems, Pittsburgh, Pa. (USA)). Jun 1975. 72p.

An analytical model is presented for the calculation of pressure and temperature variations inside an ice condenser containment during the depressurization and post-blowdown phase following a loss-of-coolant accident. The method applies conservation equations to control volumes used to simulate spatial variation. These control volumes represent the functionally distinct compartments of the ice condenser containment. The code is a modified version of the LOTIC-code. In order to reduce the computing time for a given problem, uniform mass distribution and saturated steam conditions have been assumed for each compartment. The original LOTIC assumption of uniform containment pressure has been removed and pressure differentials now exist between the compartments. Flows between these compartments are governed by hydraulic flow equations. Considerable advances have been achieved in the derivation of the conservation equations and the method of solution. Lower compartment cooling by the ice condenser drain (condensate and ice melt) and the sump water have also been incorporated in this model. The handling of the engineered safeguard systems and the calculation of structural temperature distributions are unchanged. (auth)

21674 (XN-75-19(Suppl.1)) STATISTICAL EVALUATION OF THE CARRYOUT RATE FRACTION. Lang, F. D.; Jaech, J. L. (Exxon Nuclear Co., Richland, Wash. (USA)). 25 Jun 1975. 22p. Exxon Nuclear Co., Inc., Richland, WA.

Discussions are presented on the summation of errors and statistical analyses involving goodness-of-fit, variance and standard errors of the estimate. A detailed data listing is included showing comparisons of the predicted and actual carryout rate fraction (CRF) for all FLECHT data used in the correlation. (auth)

21675 FAILURE MODES AND EFFECTS ANALYSIS AS A DESIGN TOOL FOR NUCLEAR SAFETY SYSTEMS. Tashjian, B. M. (Combustion Engineering, Inc., Windsor, CT). IEEE (Inst. Electr. Electron. Eng.) Trans. Power Appar. Syst.; PAS-94: No. 1, 97-103(1975).

From IEEE PES summer meeting and energy resources conference; Anaheim, CA (14 Jul 1974).

The activities of nuclear power plant designers are monitored by government and industry to an unprecedented degree. This involves not only rigid design and quality assurance criteria, but extensive documentation and reporting. The failure modes and effects analysis (FMEA) is a technique for checking designs and assuring quality. Included in the FMEA is a system of documentation. A simplified example of the reactor protective system (RPS) is used to illustrate the method. (auth)

21676 25 FRAGEN ZUR NUKLEAREN SICHERHEIT. (25 Questions Concerning Nuclear Safety). Atw-Broschueren "Kernenergie und Umwelt." Duesseldorf, F. R. Germany; Handelsblatt [nd]. 56p. (In German).

"K + U fragt" is the title of a permanent column of the information service "Kernenergie und Umwelt" (K + U) of the journal "atomwirtschaft-atomtechnik" (atw). Twenty-five questions and answers which always arise in the public discussion on the construction of nuclear power plants and other aspects of nuclear energy utilization are compiled. (GE)

21677 ON WHAT IS THE OPPOSITION TO NUCLEAR POWER PLANTS BASED. Alonso Santos, A. Energ. Nucl. (Madrid); 18: No. 91, 325-330(1974). (In Spanish).

A brief historical review is given of the development of nuclear safety and of the knowledge of the effects of nuclear installations on the environment. The first criteria developed on nuclear safety are outlined. The attempts by the AEC to inform the public on the safety of reactors and the possible consequences of accidents are reviewed. The development of strong opposition

to nuclear power, first in the United States and then in Europe, is summarized. (JSR)

21678 CONTROL OF RADIOACTIVE EMISSIONS IN SPANISH NUCLEAR POWER PLANTS. Trueba Bellido, P. Energ. Nucl. (Madrid); 18: No. 91, 331-336(1974). (In Spanish).

The origin of the radioactive material released from nuclear power plants is briefly described. The technical criteria to limit the emitted doses are outlined. The methods used to meet these criteria are described. (JSR)

21679 SICHERHEIT KERNTECHNISCHER EINRICHTUNGEN UND STRAHLENSCHUTZ. Rechenschaftsbericht und Programm. (Safety of Nuclear Installations and Radiation Protection. Report and Program). Bonn; Bundesministerium des Innern (1974). 236p. (In German).

13 figs.; 2 tabs.

The report to the "Innenausschuss" of the Bundestag of the German Federal Republic gives a detailed account of the safety of nuclear installations and of means and measures available for protection from radioactive radiations. It is further shown how the present safety level is to be maintained in future, especially in view of the extension of the nuclear power plant network required for reasons of power economy and energy supply. (GE)

21680 CONSEQUENCES OF WATER COOLANT ON THE BIOTOP ESPECIALLY FROM THE PERSPECTIVE OF FISHING BIOLOGY. Buhse, G. pp VP of VGB-Konferenz: Kraftwerke und Umwelt 1975. Essen; VGB Technische Vereinigung der Grosskraftwerksbetreiber e.v. (1975). (In German).

From VGB-conference: power plants and environment 1975; Essen, F. R. Germany (12 Mar 1975). 12 figs.; 12 refs. With abstract.

The effects of thermal power plants on the fish population in rivers are described. Certain factors connected with taking of coolant and discharge of lukewarm coolant have to be considered in the construction of power plants. (GE)

21681 CONSEQUENCES OF SUPPLEMENTARY SAFETY REQUIREMENTS FOR THE CONSTRUCTION OF THE NUCLEAR POWER PLANT OF THE KERNKRAFTWERK PHILIPPSBURG GmbH. Eilinghoff, K. J. (Badenwerk A. G., Karlsruhe (F. R. Germany)). VGB Kraftwerkstech.; 54: No. 12, 827-835(Dec 1974). (In German).

17 figs.

The supplementary safety requirements comprise, among others, a newer earthquake layout of the reactor building and the components, reinforcement of the condensation chamber, fire protection (e.g. fire alarm equipment with self extinguisher in the control rod operating room), design against gas or gas-cloud explosion, and design against pressure waves. These new official requirements involve additional costs of some 200 million DM for the operator. (GE)

21682 POWER PLANT OPERATION AND CLIMATE. Faust, R. pp VP of VGB-Konferenz: Kraftwerke und Umwelt 1975. Essen; VGB Technische Verinigung der Groskraftwerksbetreiber e.v.)1975). (In German).

From VGB-conference: power plants and environment 1975; Essen, F. R. Germany (12 Mar 1975). 6 refs.

A definition of climate is given, and its elements and characteristics are described. Waste heat and lost water, which are discharged into waters and atmosphere by means of various cooling systems, cause meteorological changes which are discussed with regard to their qualitative and quantitative influence on the environmental climate. Reference is also made to the numerical treatment of diffusion factors. An outlook is given on the possible long-time effects of industrial civilization, of which reactor operation is an important part, on the environmental climate. (GE)

21683 PRESENT STATE OF THE PROPAGATION CALCULATIONS. Meyer, E. pp VP of VGB-Konferenz: Kraftwerke und Umwelt 1975. Essen; VGB Technische Vereinigung der Groskraftwerksbetreiber e.v. (1975). (In German)

From VGB-conference: power plants and environment 1975; Essen, F. R. Germany (12 Mar 1975). With abstract.

A brief survey is given on calculation models by means of measured data on the propagation of: (1) Sound emissions, (2) thermal emissions in waters, (3) steam clouds from cooling towers, (4) radioactive waste air from chimneys, (5) coarse-grained dust over 10 μm and fine dust below 10 μm grain size. The diffusion of gases from chimneys is gone into in detail. (GE)

21684 EFFECT OF A LOSS OF FLOW ON A SINGLE LMFBR-TYPE FUEL PIN. Kwast, H. (Reactor Centrum Nederland, Petten). Nucl. Technol.; 26: No. 4, 430-441(Aug 1975).

Capsule irradiations are being performed on fast reactor fuel pins in a sodium environment under loss-of-cooling conditions to determine the consequences of a fuel-pin failure. Special emphasis is given to the extent of possible fuel-sodium interactions (FSI) and the relocation of the fuel. The fuel pins were neither preirradiated nor prepressurized. So far no evidence has been found for a violent FSI on fuel ejection and sodium reentry. Nevertheless, most probably a moderate FSI resulted from some fuel particles dropping into liquid sodium. These experiments indicate that considerable clad melting can occur before the fuel stack disintegrates. In addition, considerable fuel relocation can occur, which can ultimately lead to failure of the sodium containment. 14 references. (auth)

21685 SEISMIC CONSIDERATIONS FOR THE ELECTRICAL EQUIPMENTS IN NUCLEAR POWER STATIONS. Yokota, M.; Sumita, O. (Fuji Electric Co. Ltd., Kawasaki, Kanagawa (Japan). Kawasaki Factory). Fuji Jiho; 47: No. 11, 849-855(Nov 1974). (In Japanese).

Methods and the results of tests to check aseismic characteristics and aseismic design in electrical equipment for nuclear power stations are presented. (auth)

21686 THE PRESENT STATE OF REACTOR SAFETY STUDIES. Tokyo, Japan; Japan Atomic Energy Research Inst. (1974). 60p. (In Japanese).

Various aspects of the nuclear reactor safety are being studied in the JAERI. Activities in this field, with brief review of the world situation, are described: outline of the safety research works in the JAERI; safety studies on the fuels; works on the reactor-pressure-vessel boundaries; engineering safety studies for reactor loss-of-coolant accidents; research on reactor reactivity accidents; preparation of the reactor safety analysis codes; evaluation of the environmental radioactivities; management of the radioactive wastes. (JA)

21687 EXPOSITION OF CONCLUSION LED FROM EXAMINATION OF THE OPINIONS STATED IN THE PUBLIC HEARING CONCERNING THE INSTALLATION OF FUKUSHIMA SECOND ATOMIC POWER PLANT. Genshiryoku Kogyo; 20: No. 8, 43-54; v. 20(9) p. 65-75(Aug 1974). (In Japanese).

The basic concepts concerned with atomic power generation are discussed, and the safety aspects of atomic power plants are examined. (JA)

21688 RELIABILITY OF MOTOR OPERATED VALVES FOR NUCLEAR SERVICE. Yamanari, K. (Okano Valve Mfg. Co. Ltd., Kitakyushu, Fukuoka (Japan)). Karyoku Genshiryoku Hatsuden; 25: No. 7, 627-636(Jul 1974). (In Japanese).

The reliability of motor-operated valves in BWR power plants is described on the basis of the accidents in the nuclear power plants of the United States. The contents of the accident reports on motor-operated valves, causes for the accidents, and the state of accidents in Japan are described. The valves under consideration are motor-operated, with the speed reduced by gear, and the valve stems are moved up and down. To ensure the safety of nuclear power plants through the improvement of valve reliability, the causes for accidents must be known. As such, there are the aspects of specification and design, quality control in manufacturing, and installation, adjustment and maintenance. Finally, the improvement of valve reliability in Japan is considered in view of the experiences in U. S. (JA)

21689 NON-STEADY BURN OUT EXPERIMENT. Aoki, S.; Inoue, A.; Ozawa, Y. (Tokyo Inst. of Tech. (Japan). Research Lab. of Nuclear Reactor). Doryokuro Giho; No. 10, 73-85(Mar 1974). (In Japanese).

Reactor accident initiated boiling heat transfer and burnout heat flux are reported, when non-steady heat input is applied to boiling two-phase flow in a pipe, using a small size low pressure loop and a large scale high temperature and high pressure loop. As a result, it was found that as the rise time of unsteady heat input became shorter, the overshoot of fuel element wall temperature was increased and the burnout heat flux increased. (JA)

21690 NUCLEAR CONTROVERSY IN THE U. S. A. II. Conference Held at Lucerne, Switzerland, May 5-8, 1974. New York; Atomic Industrial Forum Inc. (1974). vp. (CONF-740596-).

Separate abstracts were prepared for each of the 11 papers included. (JWR)

For abstracts of individual papers see: 20436, and 21691-21700.

21691 APPROACH OF THE UNITED STATES ATOMIC ENERGY COMMISSION STUDY TO THE PUBLIC RISKS OF POWER REACTORS. Rasmussen, N. C. (Massachusetts Inst. of Tech., Cambridge). pp vp, 12p of Nuclear Controversy in the U.S.A. II. New York; Atomic Industrial Forum Inc. (1974).

From workshop on the nuclear controversy in the U.S.A.; Lucerne, Switzerland (5 May 1974). See CONF-740596-.

The methods used to identify the important accident sequences and to determine their probability of occurrence are described. The methods for the calculation of accident consequences are then discussed. (JWR)

21692 COOLING TOWERS AND THE NUCLEAR CONTROVERSY: THE AMERICAN EXPERIENCE. Philbin, T. W. pp vp, 7p of Nuclear Controversy in the U.S.A. II. New York; Atomic Industrial Forum Inc. (1974).

From workshop on the nuclear controversy in the U.S.A.; Lucerne, Switzerland (5 May 1974). See CONF-740596-.

The environmental effects of cooling towers for nuclear power plants are discussed and compared with the effects of once-through cooling systems. (JWR)

21693 CRITICS TODAY. Barfield, C. pp vp, 8p of Nuclear Controversy in the U.S.A. II. New York; Atomic Industrial Forum Inc. (1974).

From workshop on the nuclear controversy in the U.S.A.; Lucerne, Switzerland (5 May 1974). See CONF-740596-.

The positions of the most prominent critics of nuclear power in the U.S. are reviewed. (JWR)

21694 INDUSTRY'S CHANGING ROLE. Perkins, B. (Atomic Industrial Forum, Inc., New York). pp vp, 5p of Nuclear Controversy in the U.S.A. II. New York; Atomic Industrial Forum Inc. (1974).

From workshop on the nuclear controversy in the U.S.A.; Lucerne, Switzerland (5 May 1974). See CONF-740596-.

The changing public information practices of electric utilities and the nuclear industry are discussed and the factors causing the changes are analyzed. (JWR)

21695 MEDICAL ASPECTS OF POWER GENERATION PRESENT AND FUTURE. Linnemann, R. E. (Univ. of Pennsylvania, Philadelphia). pp vp, 12p of Nuclear Controversy in the U.S.A. II. New York; Atomic Industrial Forum Inc. (1974).

From workshop on the nuclear controversy in the U.S.A.; Lucerne, Switzerland (5 May 1974). See CONF-740596-.

The risks to the public from the radiation from nuclear power plants are discussed and compared to the risks of fossil fuel plants. The power-plant radiation risks are also compared to the radiation risks from other sources. (JWR)

21696 MOOD OF THE U.S. PUBLIC. Hexamer, H. D. (General Electric Co., San Jose, CA). pp vp, 5p of Nuclear Controversy in the U.S.A. II. New York; Atomic Industrial Forum Inc. (1974).

From workshop on the nuclear controversy in the U.S.A.; Lucerne, Switzerland (5 May 1974). See CONF-740596-.

A brief assessment of the public mood in the United States regarding the nuclear power question is presented. Ways for the nuclear industry to dispel fears concerning reactor safety are discussed. (JWR)

21697 NUCLEAR POWER SAFETY AND THE PUBLIC. Ray, D. L. (Atomic Energy Commission, Washington, DC). pp vp, 5p of Nuclear Controversy in the U.S.A. II. New York; Atomic Industrial Forum Inc. (1974).

From workshop on the nuclear controversy in the U.S.A.; Lucerne, Switzerland (5 May 1974). See CONF-740596-.

The problems involved in informing the public concerning the safety of nuclear power are discussed. The importance of making known the alternatives to the rapid development of nuclear power is emphasized. (JWR)

21698 PLUTONIUM PROBLEM. Johnson, E. R.; McBride, J. A. II. (E. R. Johnson Associates, Inc., Washington, DC). pp vp, 18p of Nuclear Controversy in the U.S.A. New York; Atomic Industrial Forum Inc. (1974).

From workshop on the nuclear controversy in the U.S.A.; Lucerne, Switzerland (5 May 1974). See CONF-740596-.

Topics discussed include: (1) the significance of the use of plutonium as a fuel material, (2) plutonium handling in the fuel cycle, and (3) safeguards. (JWR)

21699 REFLECTIONS ON THE MEDIA. Goldstein, C. A. II. (Atomic Industrial Forum, Inc., New York). pp vp, 6p of Nuclear Controversy in the U.S.A. New York; Atomic Industrial Forum Inc. (1974).

From workshop on the nuclear controversy in the U.S.A.; Lucerne, Switzerland (5 May 1974). See CONF-740596-.

The relationship between nuclear industry and the news media is discussed. (JWR)

21700 WHERE DO WE GO FROM HERE. Gould, W. R. pp vp, 5p of Nuclear Controversy in the U.S.A. II. New York; Atomic Industrial Forum Inc. (1974).

From workshop on the nuclear controversy in the U.S.A.; Lucerne, Switzerland (5 May 1974). See CONF-740596-.

Some predictions concerning the future of nuclear power and the controversy surrounding it are offered. (JWR)

21701 REWETTING OF A HOT SURFACE. Thompson, T. S. (Atomic Energy of Canada Ltd., Chalk River, Ont.). pp 139-143 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

The rewetting of a hot cladding surface following various anomalous nuclear reactor operating situations is governed by two-dimensional conduction in the cladding wall. A correlation in the form of the approximate analytical solution to the two-dimensional conduction problem is suitable for predicting the rewetting velocity, i.e. 1/v equals rho c(T$_2$ - T/sub c/)/phi/sub eff/. The physical basis of this equation is explained and arguments are presented based on more exact analysis as to why wall thickness, wall thermal conductivity, rod diameter, heat generation rate, and coolant flow rate are not included. (auth)

21702 METHOD FOR THE CORRELATION OF TRANSITION BOILING HEAT TRANSFER DATA. Ramu, K.; Weisman, J. (Univ. of Cincinnati). pp 160-164 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

In view of the importance of transition boiling heat transfer to the safeguards analysis of water-cooled nuclear reactors, the available data on transition boiling of water under flow condition has been reevaluated. A revised correlation, which can predict transition boiling heat transfer coefficients under both post-burnout and reflooding conditions, has been developed. (auth)

21703 TRANSIENT BOILING CRISIS DURING RAPID DEPRESSURIZATION. Aoki, S.; Inoue, A.; Kozawa, Y. (Tokyo Inst. of Technology). pp 250-254 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

The heat transfer and burnout phenomena at depressurization from 3 kg/cm^{2}a to atmosphere were studied. Considering the initial subcooling, flow velocity, and heat input as the parameters, the following results were obtained: The boiling heat transfer became very well during the process and then the situation stayed on the extension of the steady nucleate boiling characteristic curve until burnout inception. The burnout occurred at the higher heat flux than the steady burnout and never did occur at the first sudden vaporization just after rapid depressurization but it was delayed for a while (burnout time). (auth)

21704 ROD-CENTERED SUBCHANNEL ANALYSIS WITH TURBULENT (ENTHALPY) MIXING FOR CRITICAL HEAT FLUX PREDICTION IN ROD CLUSTERS COOLED BY BOILING WATER. Gaspari, G. P.; Hassid, A.; Lucchini, F. (CISE, Milan). pp 295-299 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

An analysis is made of a recently suggested new concept, based on a "rod-centered" subchannel subdivision, for critical heat flux prediction in rod cluster geometry, to overcome some limitations of interest for nuclear reactor safety assessment. On the basis of an appropriate selection of data, an expression is derived to take into account enthalpy exchange between subchannels. This expression, together with an accurate round tube correlation, appears to take into account satisfactorily most parameters affecting heat flux in the conditions of interest in reactor safety. (auth)

Reactor Theory and Calculation

Refer also to abstract 21526.

21705 (AEEW-R-1002) TUTANK: A TWO-DIMENSIONAL NEUTRON KINETICS CODE. Watts, M. G.; Halsall, M. J.; Fayers, F. J. (UKAEA Reactor Group, Winfrith. Atomic Energy Establishment). Apr 1975. 56p. Dep. NTIS (US Sales Only) $6.00.

TUTANK is a two-dimensional neutron kinetics code which treats two neutron energy groups and up to six groups of delayed neutron precursors. A "theta differencing" method is used to integrate the time dependence of the equations. A position dependent exponential transformation on the time variable is available as an option, which in many circumstances can remove much of the time dependence, and thereby allow longer time steps to be taken. A further manipulation is made to separate the solutions of the neutron fluxes and the precursor concentra-

tions. The spatial equations are based on standard diffusion theory, and their solution is obtained from alternating direction sweeps with a transverse buckling—the so-called ADI-B^2 method. Other features of the code include an elementary temperature feedback and heat removal treatment, automatic time step adjustment, a flexible method of specifying cross-section and heat transfer coefficient variations during a transient, and a restart facility which requires a minimal data specification. Full details of the code input are given. An example of the solution of a NEACRP benchmark for an LWR control rod withdrawal is given in an appendix. (auth)

21706 (CEA-N-1797) INTEGRATION OF NUCLEAR REACTOR KINETIC EQUATIONS BY SUBROUTINE NEPTUNE AND COMPARISON WITH TWO CLASSICAL INTEGRATION METHODS. Monsef, Y.; Zwingelstein, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Services d'Electronique). 10 Mar 1975. 10p. (In French). INIS.

An application of the programme NEPTUNE, a non linear transient subroutine, for the integration of nuclear reactor kinetic equations which are the stiff kind is described. The obtained results show the high integration stability and a lower computation time compared to classical integration methods. (FR)

21707 (GEAP-14014) FONDLE: A COMPUTER CODE FOR COMPARING EXPERIMENTAL AND ANALYTICAL DATA. Crick, S. (General Electric Co., Sunnyvale, Calif. (USA). Breeder Reactor Dept.). Mar 1975. Contract AT(04-3)-893. 85p. Dep. NTIS $5.45.

The computer code FONDLE was designed and programmed to compare large data arrays and to correlate calculations and experimental results. Using the code one can find the quantitative assessment of an agreement between two sets of results through the determination of uncertainty and bias factors. These factors are determined with least square fitting techniques. Other comparisons that can be performed at the pointwise level are calculating of ratios and finding products or summations of three dimensions arrays. Quantitative comparisons can be made through the use of two-dimensional contour plots or three-dimensional contour plots or three-dimensional perspective view plots. Incorporated into the coding are a number of maintenance options to maneuver arrays into positions of usefulness. That is, arrays can be inverted, unfolded, truncated or rotated into positions where comparisons or calculations can be accomplished. (auth)

21708 (SES/INT/SAI-75-21) INTEGRATION OF NUCLEAR REACTOR KINETIC EQUATIONS BY SUBROUTINE NEPTUNE AND COMPARISON WITH TWO CLASSICAL INTEGRATION METHODS. Monsef, Y.; Zwingelstein, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Services d'Electronique). 4 Feb 1975. 13p. (In French). Dep. NTIS (US Sales Only) $4.00.

An application is described of the program NEPTUNE, a nonlinear transient subroutine, for the integration of nuclear reactor kinetic equations which are the stiff kind. The obtained results show the high integration stability and a lower computation time compared to classical integration methods. (4 references) (auth)

21709 UNSTEADY THERMAL STRESSES IN A SQUARE PRISM WITH A CIRCULAR HOLE UNDER UNIFORM HEAT GENERATION. Noda, N. (Shizuoka Univ., Hamamatsu (Japan). Faculty of Engineering); Takeuti, Y. Nippon Kikai Gakkai Rombunshu; 40: No. 335, 1879-1887(Jul 1974). (In Japanese).

The thermal stress problem in a regular-polygonal region with a circular hole is important since it is encountered in a reactor core of cellular array. In the case of reactor startup or shutdown, it causes unsteady thermal stress. In the present study, similarly to the case of steady thermal stress in normal operation, unsteady thermal conduction was analyzed by Laplace transformation in the polygonal region with a circular hole under uniform heat generation, and the problem of unsteady thermal stress was analyzed by utilizing the side-point technique from the result of temperature distribution. In the analysis by thermal-stress functional method, the unknown constants for a multiple-connection region were determined by satisfying Michell's conditional formula. Numerical calculation was made for the square region with a circular hole under uniform heat generation, with both boundaries being maintained at zero degrees, and the temperature distribution and thermal stress distribution were determined. (JA)

21710 DEFINITION AND USE OF BUCKLING. Ritchie, A. I. M. (Australian Atomic Energy Commission Research Establishment, Lucas Heights); Moo, S. P. J. Nucl. Sci. Technol. (Tokyo); 11: No. 12, 535-544(Dec 1974).

The buckling concept is used in conjunction with diffusion asymptotic theory and examined with particular reference to pulsed systems. It is shown that the definition of buckling depends on the problem posed. The following three problems are considered: (1) Comparison of a one mode diffusion theory calculation with experimental spatial distributions, with particular reference to pulsed fast systems. (2) Comparison of measured and calculated extrapolation distances inpulsed thermal systems. (3) Extrapolation distance appropriate to decay constant estimations in thermal systems. (auth)

21711 ESTIMATION OF ANISOTROPIC EFFECT OF DIFFUSION COEFFICIENT IN A FAST CRITICAL ASSEMBLY. Takeda, T.; Kurihara, K.; Yamamoto, M. (Hitachi Ltd., Kawasaki, Kanagawa (Japan). Atomic Energy Research Lab.). J. Nucl. Sci. Technol. (Tokyo); 11: No. 10, 422-433(Oct 1974).

The effect of neutron streaming upon the neutron multiplication factor in the fast critical assembly FCA-VI is estimated by considering the anisotropy of the diffusion coefficient. The Benoist formula is adopted to obtain the diffusion coefficient. In his original expression, many effects such as those of neutron angular distribution, multiple collision (correlation of different neutron passes) and finiteness of the lattice system are included. In order to estimate these effects, the generalized first-flight collision probability method is adopted as in the previous paper, and an improvement is brought over the previous method so as to calculate the effective diffusion coefficient in a practical slab lattice cell which is asymmetric about the center of the cell. Using the method of calculation described above, the anisotropic effect of neutron streaming in the lattices TA, TB, TC and TD used in the FCA VI-1 assembly is estimated. The effect of anisotropy of the diffusion coefficient upon the multiplication factor for the TA, TB, TC and TD lattices is found to be -0.156, -0.181, -0.242 and -0.330% $\Delta k/k$, respectively. For the TA lattice, 30% of the overall effect of anisotropy is attributable to multiple collision. (auth)

21712 HEXAGA II: TWO-DIMENSIONAL DIFFUSION CODE FOR MULTIGROUP NEUTRON FLUX CALCULATION IN HEXAGONAL LATTICES. Apostolov, T. (Inst. of Nuclear Research and Nuclear Energy, Sofia); Wolnicki, Z. At. Energ. (USSR); 38: No. 6, 372-374(Jun 1975). (In Russian).

A two-dimensional multigroup code, HEXAGA II, for the solution of the diffusion equation in hexangular lattices, is considered. HEXAGA II employs a model of homogeneous triangular lattices of various types of reactors, basically a PWR. Two to ten energy groups maybe represented, taking into account neutron slow-down. Neutron scattering accompanying increase in energy is taken into account in the model where two or three thermal groups are represented. The solution of the set of differential equations is based on the two-sweep iterative method for multidimensional reactor computations, which is described. The first version of the code, which at present is being written in FORTRAN for CYBER-70, calculates the neutron flux at 5,000 mesh points. In extended versions, this number will increase to 10,000 or more. 9 references. (auth)

Reactor Components and Accessories

Refer also to abstracts 19641, 19647, 19655, 20293, and 20361.

21713 (AED-CONF-74-712-001) RELIABILITY DATA ACQUIRED IN OPERATING EXPERIENCE. P. 1. Heuser, F. W.; Hoemke, P. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e. V., Koeln (F. R. Germany)). 1974. 23p. (In German). INIS.

From KTG special seminar on statistic methods; Berlin, F. R. Germany (5 Mar 1974).

The paper deals with reliability data from operating experience, i.e., acquisition of data from plant operation. The following steps are necessary for data acquisition: (a) accumulation of operation and failure data, (b) classification of these data in accordance with existing classification criteria, (c) storage of these data for sorting and evaluation with regard to fields of special interest within the total inventory. Along with the description of failure evaluation, a model case is presented and provisionally evaluated. (GE)

21714 (AED-CONF-75-038-000, pp vp) RELIABILITY CONSIDERATIONS ON TURBINE SAFETY. Martin, P. 1975. (In German).

From VGB professional meeting on steam turbines and steam turbine operation 1975; Mannheim; Duesseldorf; Hamburg, F. R. Germany (21 Feb 1975).

23 figs.; 19 refs. With abstract.

In VGB professional meeting on steam turbines and steam turbine operation 1975. Papers. (VGB Technische Vereinigung der Grosskraftwerksbetreiber e. V., Essen (F. R. Germany)).

Three different classes of criteria are considered to determine the reliability of protective systems for steam turbines. The probabilities of different kinds of disturbances or failures are used for fault tree analyses which help to determine the final layout of redundant control loops. The switching sequences of different protective systems are important parts of this systems analysis. (GE)

21715 (CONF-7209129-1) ANALYSIS AND COMPUTATION OF STEAM SURGE TANK PRESSURE TRANSIENTS. Gorman, D. J.; Gupta, R. K. (Ottawa Univ., Ontario (Canada)). 1972. 20p.

From international conference on pressure surges; Canterbury, UK (6 Sep 1972).

The need for a solution to the problem of predicting steam surge tank pressure transients, for prescribed time variations in liquid level, has become particularly acute with the advent of the nuclear power reactor. These pressure transients may cause unacceptable piping system stresses. In addition, changes in coolant density associated with pressure transients can cause serious alterations in reactivity and thus interfere with reactor control. The theoretical models and computational techniques utilized for predicting pressure transients during prescribed rates of increase or decrease of tank level are described. The analytical approach is a rigorous one and is somewhat unique in that no empirical system constants are required. Included is a computer flow chart which is based on the theoretical models and can be used to predict pressure transients for any steam surge tank containing light or heavy water. Experimental data obtained from numerous tests on an actual heavy water reactor surge tank, for both insurge and outsurge, is included. It is found that the isentropic models for compression and expansion of the vapour are highly inappropriate, and very good agreement between experiment and predictions is obtained with the above analysis. While the analysis and development of computational methods was conducted primarily to solve liquid insurge and outsurge problems associated with nuclear power plant surge tanks it is obvious that the results apply to any vessel where compression or expansion of a vapour is brought about by changes in level of the liquid phase. (auth)

21716 (CONF-740301-5) FRICTION AND WEAR IN SODIUM. Hoffman, N. J.; Droher, J. J. (Liquid Metal Engineering Center, Canoga Park, Calif. (USA)). 1973. Contract AT(04-3)700. 29p. Dep. NTIS $4.50.

From NACE meeting - corrosion/74; Chicago, Illinois, USA (4 Mar 1974).

In the design of a safe and reliable sodium-cooled reactor one of the more important problem areas is that of friction and wear of components immersed in liquid sodium or exposed to sodium vapor. Sodium coolant at elevated temperatures may severely affect most oxide-bearing surface layers which provide corrosion resistance and, to some extent, lubrication and surface hardness. Consequently, accelerated deterioration may be experienced on engaged-motion contact surfaces, which could result in unexpected reactor shutdown from component malfunction or failure due to galling and seizure. An overall view of the friction and wear phenomena encountered during oscillatory rubbing of surfaces in high-temperature, liquid-sodium environments is presented. Specific data generated at the Liquid Metal Engineering Center (LMEC) on this subject is also presented. (auth)

21717 (ERDA-tr-47) APPLICATION OF WELD FORMING TECHNIQUE TO MANUFACTURING OF AUSTENITIC STAINLESS STEEL ELBOW FOR NUCLEAR POWER PLANT SERVICE. Ujiie, A.; Sato, S.; Sunamoto, T.; Yamamoto, M.; Uragami, K.; Hamanaka, A. 1974. Translation of Mitsubishi Technical Bulletin No. 96. 61p. Dep. NTIS $6.25.

In order to apply austenitic stainless steel pipes manufactured by the weld forming technique to the main coolant pipes of the light water reactor of a nuclear power plant, metallurgical, mechanical, and various other data required for the approval of new materials provided by the ASME Code Section III Appendix IV and also by the Japan Welding Engineering Society (J. W. S.) were established by using the elbow models of actual size manufactured by the weld forming technique. (auth)

21718 (MRR-143) FAILURE BEHAVIOR OF A DYNAMIC TRIP UNIT. Gossner, S. (Technische Univ. Muenchen, Garching (F. R. Germany). Lab. fuer Reaktorregelung und Anlagensicherung). Feb 1975. 38p. (In German). Dep. NTIS (US Sales Only) $5.00.

Analysis is presented of the failure-effects of an electronic trip-unit (bistable unit), which works on a dynamic principle. On the one hand the failure effects are discussed only in view of the outputs of the unit without regard to the surrounding system. Additionally, considerations were made in the way the failures would affect safety actions which could never impair the safety of the power plant (like the reactor shutdown). Considerations were also made for those safety actions which could possibly reduce the safety of the power plant if they had a false start. The results of the analysis show that the bistable unit has only a single unrevealed dangerous failure if all active failures are indicated. The results are shown in such a manner that it is easily possible to use other failure rates for every component. 5 references. (auth)

21719 (MRR-146) ANALYTICAL ONE-DIMENSIONAL FREQUENCY MODEL FOR U-TUBE HEAT EXCHANGERS WITH RESPECT TO THE INPUT AND OUTPUT MASS FLOW TEMPERATURES ON THE PRIMARY AND SECONDARY SIDES. Kosowski, R.; Hoeld, A. (Technische Univ. Muenchen, Garching (F. R. Germany). Lab. fuer Reaktorregelung und Anlagensicherung). Apr 1975. 61p. (In German). Dep. NTIS $6.25.

A linear, one-dimensional analytical frequency response model for U-tube heat exchangers will be presented. The model calculates the frequency response behavior of fluid-temperatures both on the primary and secondary side at any position (and in particular at the outlet) of the heat exchanger with respect to perturbations of inlet fluid temperatures and inlet fluid mass flows. (auth)

21720 (RDT-M-3-9T(7-75)) NICKEL-IRON-CHROMIUM ALLOY SEAMLESS PIPE AND TUBING (ASME SB-407 WITH ADDITIONAL REQUIREMENTS. Fuller, R. M. (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). 5 Aug 1975. 8p. RSO.

A standard covering specifications for nickel-iron-chromium alloy seamless pipe and tubing for nuclear applications is presented. (TSS)

21721 (RDT-M-17T(7-75)) NICKEL-MOLYBDENUM-CHROMIUM ALLOY WELDED PIPE. (ASME SA-358 With Additional Requirements). (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). Oct 1972. 8p. RSO.

A standard covering nickel-molybdenum-chromium alloy welded pipe for nuclear service is presented. (TSS)

21722 (RT/ING-(74)35) REBO: COMPUTER CODE FOR THE GENERATION OF A THREE-DIMENSIONAL FINITE-ELEMENT GRID OF THE NOZZLE-CYLINDRICAL VESSEL JUNCTION ZONE. Massini, G.; Zolti, E. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Dec 1974. 154p. (In Italian). Dep. NTIS (US Sales Only) $10.75.

The REBO computer code was written for the automatic generation, with relatively simple input data, of cylindrical coordinates for the three-dimensional finite-element grid of thick-walled nozzle-cylindrical vessel junctions with curved transitions. REBO, developed by CNEN, is a FORTRAN IV code written for the IBM System 370. The report describes the main features of REBO; besides, it serves as a user's manual for the code. (auth)

21723 (TUBIK-40) WOTAN: A DIGITAL PROGRAM FOR THE SIMULATION OF A ONCE-THROUGH STEAM GENERATOR. Luebbesmeyer, D. (Technische Univ. Berlin (F. R. Germany). Inst. fuer Kerntechnik). Dec 1974. 84p. (In German). Dep. NTIS (US Sales Only) $7.25.

A digital program is formulated for the simulation of a once-through steam generator. The program developed for steam generators with spiral placement of the generator pipes gives good results in dynamic comparison with experimental data. The calculations also show that the model can be used in the simulation of large-scale perturbations. It can therefore supplement reactor simulation programs by a more accurate description of the heat drop and by prediction of the effect of primary loop perturbations on the secondary circuit. The numerical methods introduced for the solution of the differential equation system describing hyperbolically both steam generator sides remain stable in all calculations when the mesh number, especially on the secondary side, does not exceed a given limit and the channel input rate is not too small. (tr-auth)

21724 SEALED HOUSING FOR ELECTRIC EQUIPMENT EXPOSED TO FAST PRESSURE WAVES. Korner, R. L. (To Westinghouse Electric Corp.). German(FRG) Patent 2,441,523/A/. 6 Mar 1975. 9p. (In German).

4 figs.

A housing suitable for nuclear reactor containments is claimed. It allows an airtight design of electrical conductors and prevents the escape of radioactive gases in a reactor accident. (GE)

21725 DEVICE FOR THE REGULATION OF THE COOLANT FLOW RATE IN A NUCLEAR POWER PLANT AFTER REACTOR SHUTDOWN. Bieniussa, K.; Kappauf, H. (To Internationale

Atomreaktorbau GmbH). German(FRG) Patent 2,340,548/A/. 20 Feb 1975. 9p. (In German).

1 fig.

A device for coolant flow rate regulation in a nuclear facility after reactor shutdown is claimed. The heat produced in the reactor is removed through reactor coolant pipes with a shutoff device by means of pumps of variable power. (GE)

21726 REACTOR INSTRUMENTATION. Schruefer, E. (Kraftwerk Union A. G., Offenbach (F. R. Germany)). VDI (Ver. Dtsch. Ing.) Z.; 117: No. 6, 305-308(Mar 1975). (In German). 89 refs.

A short survey on the fields of radiation and neutron flux measurement, noise and correlation analyses, reactor safety, and facility planning and construction is presented. (GE)

21727 RELIABILITY MANAGEMENT ACTIVITIES FOR NUCLEAR AND PROCESS INSTRUMENTATION EQUIPMENT FOR NUCLEAR POWER PLANTS. Hattori, Y.; Yoshida, K.; Ebara, Y.; Shimazaki, K.; Naito, T. (Tokyo Shibaura Electric Co. Ltd., Fuchu (Japan). Fuchu Works). Toshiba Rebyu; 29: No. 12, 1022-1025(Dec 1974). (In Japanese).

Activities are described for the management of reliability of apparatus for nuclear and process instrumentation developed and manufactured by Toshiba: the reliability program, reliability design, purchase control, quality control in production process, reliability test, and quality control after delivery. (auth)

21728 NUMERICAL METHODS OF SOLVING TRANSFER EQUATIONS IN REACTOR SHIELDING PROBLEMS. Germogenova, T. A. At. Energ. (USSR); 38: No. 6, 401-405(Jun 1975). (In Russian).

The paper contains a review of methods of solving the boundary value problems for multi-group transfer equations in the case of neutron and photon transport. The first stage of constructing the solution, difference approximation of the boundary value problem, essentially depends on the properties of the solution, its singularities and asymptotes. In the second stage, solution of the system of difference equation, various modifications of iterative methods are used. A description of our basic codes (ROZ and RADUGA) for solving transfer boundary value problems and results of methodological investigations are given. 28 references. (auth)

21729 PROBLEMS OF SECONDARY GAMMA-RADIATION IN REACTOR SHIELDING. Abagyan, A. A.; Germogenova, T. A.; Dubinin, A. A.; Zhuravlev, V. I.; Klimanov, V. A.; Kostin, E. I.; Mashkovich, V. P.; Sakharov, V. K.; Utkin, V. A. At. Energ. (USSR); 38: No. 6, 406-409(Jun 1975). (In Russian).

This paper presents the results of theoretical calculations of regularities in the formation and yield of secondary gamma-radiation in reactor shielding. The calculations of radiation fields were performed using the ROZ-5 code providing the solution of transport equations by the characteristics method. The dependence of secondary gamma-radiation field on the energy and angular distribution of neutron sources has been studied. Data on secondary gamma-radiation from a layer of shielding consisting of various materials have been obtained. Data on the contribution of secondary gamma-radiation to the dose and other integral characteristics often used in calculating reactor shielding are presented. 6 references. (auth)

Reactor Fuels

Refer also to abstracts 19252, 19391, 19415, 19418, 20202, and 21698.

21730 (ORO-4212-16) QUANTITATIVE DETERMINATION OF THE STRUCTURE-PROPERTY RELATIONSHIPS IN NUCLEAR FUEL ELEMENT MATERIALS. Final Report, June 1969--July 1973. Rhines, F. N.; DeHoff, R. T.; Whitney, E. D. (Florida Univ., Gainesville (USA). Engineering and Industrial Experiment Station). May 1975. Contract AT(40-1)-4212. 255p. Dep. NTIS $15.75.

New developments in quantitative microscopy are first described. The use of the described techniques to quantitatively characterize the microstructural states of nickel and uranium dioxide samples is then discussed. The determination of gas permeability, thermal conductivity, mechanical properties, and creep behavior in the characterized samples are also described. (JWR)

21731 FUEL RODS. Inagaki, K.; Kato, K. (To Hitachi Ltd., Tokyo (Japan)). Japanese Patent 1974-5156/B/. 23 Jul 1969. 3p. (In Japanese).

This invention pertains to fuel rods of simple construction allowing burn-up to be accurately and completely controlled in case of an accident. Prior art fuel rods generally relied upon a supporting plate provided at the lower portion of a cladding tube below the stacked fuel pellets which is caused to melt at the onset of an accident in which the neutron flux density becomes excessively large, whereupon the pellets fall to a level of lesser neutron flux density allowing burn-up to be controlled. However, the pellets may not completely slide out even when the supporting plate melts. This invention solves the aforementioned problem by providing a mechanism whereby a neutron absorbing pellet sandwiched within a frame of fissionable material located above the fuel pellets falls, due to its lower rate of thermal expansion, at the onset of the aforementioned accident. The leakage of unabsorbed neutrons leads to the generation of heat, the frame expands more than the sandwiched neutron absorbing pellet, whereby the pellet falls upon the fuel pellets to control burn-up. If a space is provided in the upper portion of the tube by removing a fuel pellet, the neutron absorbing pellet assumes this position when it falls, increasing the efficiency of neutron absorption and allowing more complete control of burn-up. (JA)

Reactor Control Systems

21732 (AECL-5045) ON-LINE CONTROL OF THE CANDU-PHW POWER DISTRIBUTION. Hinchley, E.; Kugler, G. (Atomic Energy of Canada Ltd., Sheridan Park, Ontario. Power Projects). Mar 1975. 39p (CONF-7410124-2). Dep. NTIS (US Sales Only) $5.00. AECL $1.00.

From IAEA specialists meeting on spatial control problems; Studsvik, Sweden (28 Oct 1974).

Higher mode instability in Canada Deuterium Uranium-Pressurized Heavy Water (CANDU-PHW) cores is primarily due to xenon feedback effects. On-line spatial control is achieved through a redundant multi-purpose control computer system and a virtually continuous flux mapping procedure combined with a liquid control absorber system. The on-line calculational methods and hardware aspects of these systems are described. (auth)

21733 (BAW-10082(Pt.2)) ENVIRONMENTAL QUALIFICATION METHODS. Part 2. Ertel, R. G. (Babcock and Wilcox Co., Lynchburg, Va. (USA). Nuclear Power Generation Div.). Jul 1975. 20p. Babcock and Wilcox Co., Lynchburg, VA.

BAW-10082 covers the planned qualification testing for B and W Class 1E control and instrumentation (C and I) equipment. The present report (Part 2) describes environmental qualification test methods and procedures. The qualification test design bases include the operational requirements for monitored parameters and define the normal and accident conditions representative of typical Class 1E C and I equipment locations. The qualification test levels and results will be submitted under separate cover concurrent with the FSAR submittal of applicable contracts. (auth)

21734 (GEAP-14030-2) CONTROL ASSEMBLY ENGINEERING SECOND QUARTERLY REPORT, NOVEMBER 1974-JANUARY 1975. (General Electric Co., Sunnyvale, Calif. (USA). Breeder Reactor Dept.). 1975. Contract AT(04-3)-893. 15p. AT.

Progress is described for subtasks related to FTR irradiation, interface activities with HEDL and ORNL and the advanced absorber assembly design trade-off study. (auth)

21735 (GKSS-75/E/4) POSSIBILITIES AND LIMITS OF THE REACTIVITY DETERMINATION OF CONTROL RODS. Buenemann, D. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (F. R. Germany). Inst. fuer Physik). 1975. 16p. (In German). INIS.

From KTG-discussion meeting of the Fachgruppe Reaktorphysik; Bensberg, F. R. Germany (17 Sep 1974).

2 figs.; 2 refs.

Basic physical facts of the reactivity determination of control rods are presented. A survey of currently applied methods is given, and the drawbacks of the various methods are pointed out. Special problems are presented by the interpretation of highly subcritical assemblies which are not really important in practical reactor operation but desirable for a consistent comparison between theory and experiments. (INIS)

21736 (INIS-mf-1666) SIMULATION OF BRUCE PHW NUCLEAR GENERATING STATION FOR CONTROL STUDIES. Stebbing, J. D.; Luxat, J. C. (Atomic Energy of Canada Ltd., Sheridan Park, Ontario. Power Projects). 1973. vp. INIS.

From 1973 summer computer simulation conference; Montreal, Quebec, Canada (17 Jul 1973).

Published in "Proceedings of the 1973 summer computer simulation conference". Simulation Councils, Inc., La Jolla, Calif. (USA), 1973, p. 436-441. Sponsoring societies: AICHE, AMS, ISA, SCI, SHARE.

A simulation study of the Bruce PHW Nuclear Generating Station is outlined. The purpose of the simulation is to assist

in the design of control and safety systems for the station and to aid the debugging and pre-commissioning testing of computer control programs. The simulation was implemented entirely as a digital simulation on a mini-computer-based computing facility. The philosophy underlying the choice of an all-digital implementation is presented, and the extremely flexible, and highly interactive nature of the resulting simulation package is stressed. (auth)

21737 (WANL-TME-258) DEVELOPMENT PLAN FOR NUCLEAR INSTRUMENTATION SYSTEM (FOR INCLUSION IN INSTRUMENTATION DATA BOOK) (PRELIMINARY). (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 4p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

The development of an adequate reactor control system requires that reactor neutron flux be measured and calibrated as reactor power over ten decades of power level. Nuclear instrumentation must convert low level neutron detector signals to a logarithmic analog signal of reactor power. This analog power signal must be of a sufficient impedance level to be used by control system amplifiers. Neutron detector and instrumentation calibration requires three ranges of measurement to cover the ten decades of power required. Fission counter neutron detectors will be used in the source and intermediate range and an ionization chamber detector will be used for the power range neutron flux measurements. Five decades of power covering 10^{-5} to full power will be measured by the power range instrumentation channels. Intermediate range instrumentation channels will measure four decades of power from 10^{-8} to 10^{-4} of full power. Source range instrumentation channels will measure 3 decades of power from 10^{-10} to 10^{-6} of full power. Overlapping decades will be used for switching and calibration purposes in the control system. A development plan for such a system is outlined. (auth)

21738 THE PARAMETER SURVEY TEST OF PRESSURE CONTROL SYSTEM FOR BWR POWER STATION. Tanabe, A.; Akashi, T. (Tokyo Shibaura Electric Co. Ltd., Kawasaki, Kanagawa (Japan)). Karyoku Genshiryoku Hatsuden; 25: No. 6, 553-563(Jun 1974). (In Japanese).

The studied pressure control system for BWR power stations is the mechanical hydraulic control type, with a steam control valve and a turbine bypass valve regulated by link mechanisms. For the link mechanism, the devices of producing pressure-control signals consists of the EPR (electrical pressure regulator) and the MPR (mechanical pressure regulator). The EPR, incorporating recent electro-hydraulic control technology, has been tested both individually and in the actual BWR plant. The parameter survey on the control constants of the EPR showed its good characteristics. The regulator is also superior in hysteresis. Its advance/delay time constants can be varied independently, so that the parameter survey is possible in a wide range. The relation between stability of the pressure control system and setting of the control constants was clarified analytically. (JA).

21739 PRESENT STATUS AND PROBLEM OF THE CONTROL OF HIGH TEMPERATURE GAS COOLED REACTOR (HTGR). Fukuhara, M. (Kawasaki Heavy Industries Ltd., Kobe (Japan). Technical Research Lab.). FAPIG (Tokyo); No. 73, 12-18(May 1974). (In Japanese).

The indirect cooling system of HTGRs has an intermediate heat exchange system and causes problems concerning plant controllability, thermal shock and thermal stress. Characteristics of the control of HTGRs are self-stability of the reactor core, longer neutron life than that of light water reactors, small reactivity effect of coolant, large heat capacity of the core and small heat capacity of the gas, and gradual temperature variation of the core. A few examples of the control systems are presented. Since the system for HTGRs is usually an indirect heat exchange system, structural material may be used under severe conditions. Problems to be investigated are temperature when the gas circulators stop, temperature at the time of scram, pressure when pressure control stops and so on. It is necessary to do an analysis of the characteristics of components of the whole plant in order to analyze the controllability of multi-purpose reactors. Investigation of unstable gas flow in the core and interference due to the connection of different loads must be made. Purification control is also important. (JA)

21740 NUCLEAR INSTRUMENTATION FOR PRESSURIZED-WATER REACTORS. Kawashima, K. (Mitsubishi Electric Corp., Amagasaki, Hyogo (Japan). Central Research Lab.); Yoshijima, U.; Ueda, T.; Matsuo, M. Mitsubishi Denki Giho; 48: No. 11, 1292-1296(Nov 1974). (In Japanese).

The nuclear instrumentation system described is used for continuous supervision of the neutron-beam level in the reactor of the No. 2 unit of Kansai Electric Power's Takahama Power Plant. It consists of a neutron detector and an electronic circuit that processes the detector's signals. Since a very broad range of items are metered, the system output is divided into three sections: (1) a trip signal for assuring the safety of the reactor; (2) an alarm signal; and (3) signals for reactor control. (auth)

21741 ASSESSMENT OF BOILER TUBE TEMPERATURE CHANGE DURING DRYOUT IN NUCLEAR STEAM RAISING PLANT. Chojnowski, B.; Haigh, C. P. (Marchwood Engineering Labs., Southampton, Eng.). pp 170-174 of Heat Transfer, 1974. Vol. 4. Washington, DC; Scripta Book Co. (1974).

From 5th international heat transfer conference; Tokyo, Japan (3 Sep 1974). See CONF-740925-P4.

A method is described for transposing critical heat flux data obtained on channels operating under heat flux controlled conditions to channels of equivalent geometry operating under temperature controlled conditions. The application of the method is demonstrated with a numerical example where the location of the dryout region and the axial temperature distribution have been determined for a steam generating channel of a sodium heated evaporator. (auth)

Nuclear Power Plant Economics

Refer also to abstract 21771.

21742 WHY SHOULD NEW ELECTRICAL POWER PLANTS BE NUCLEAR. Caturla Camino, J. Energ. Nucl. (Madrid); 18: No. 91, 287-292(1974). (In Spanish).

The existing coal and hydroelectric resources in Spain are summarized and possible new sources such as solar, geothermal, winds, tides, and thermal gradients of the ocean are evaluated for their economic development and applicability in Spain. The possible energy sources that can be imported are petroleum, natural gas, and uranium. The cost of these fuels on the cost of the electrical energy obtained is evaluated. It is concluded that the electrical power produced by nuclear power plants will cost less than that produced by petroleum-fired plants. (JSR)

21743 NUCLEAR PROGRAMS OF THE WORLD. Gutierrez Marti, F. Energ. Nucl. (Madrid); 18: No. 91, 293-298(1974). (In Spanish).

The present and projected development of nuclear power plants in the world and a comparison of the percentage of electricity produced by these and hydroelectric and thermal power plants are discussed. The increasing needs in Spain for power and electrical energy are reviewed and the planned installation of nuclear power by 1985 is indicated. (JSR)

21744 DIE ELEKTROTECHNIK AUS NATIONALER AND INTERNATIONALER SICHT. T. 1. Energietechnik. (Electrical Engineering from a National and International Point of View. I. Energy Technology). Mandel, H. (Rheinisch-Westfaelisches Elektrizitaetswerk A. G., Essen (F. R. Germany)). DAtF-Sonderdrucke. Bonn, F. R. Germany; DAtF (Dec 1974). 8p. (In German).

16 figs. Special print from Elektrotech. Z., A (1974), no. 12 p. 634-641. Also issued as AED-Conf-74-473-001.

A survey is given of the situation in the field of power engineering which is strongly influenced by the electrotechnical development. The paper discusses the essential problems to be solved with regard to energy generation now and in the future, problems such as financial requirements, planned power plant capacities, unit capacities, availability, cooling, turbogenerator output, standardization, direct energy conversion and transmission systems. (GE)

21745 THE FUTURE NUCLEAR POWER PLANT: A HEATING POWER STATION. Korek, J. pp VP of VGB-Konferenz: Kraftwerke und Umwelt 1975. Essen; VGB Technische Vereinigung der Grosskraftwerksbetreiber e.v. (1975). (In German)

From VGB-conference: power plants and environment 1975; Essen, F. R. Germany (12 Mar 1975). 7 figs.; 1 tab.; 5 refs.

By means of a few figures and diagrams it is concluded that: (1) The delivery of heat from nuclear power plants is economical at the present price situation up to a transport distance of about 35 km. It should become even more economical due to the expected price increase for fossil fuels. The nuclear power plant of the future is thus to be a heat power plant. (2) It is advisable to erect nuclear power plants close to concentrated populated regions in order to reduce the investments for the transport. (3) Considering the great heat demand it seems necessary to account for the possibility of a sufficiently large heat removal in the current planning of nuclear power plants. (4) The progressive expansion of nuclear heat power plants will result in a reduction of the primary energy consumption, a reduction of the

petroleum share in the energy balance, and an easing of the environmental relationships in the particularly affected concentrated areas. (GE)

21746 JAPANESE NUCLEAR INDUSTRY AT THE LANDING. Challenge to Nuclear Power Generation Age. Genshiryoku Chosa Jiho; No. 25, 1-64(May 1974). (In Japanese).

In JAIF's investigation into the actual condition of the nuclear industry in Japan in fiscal year 1972, a detailed analysis is presented about the trends of expenditures, sales and personnel, and future prospects. (JA)

21747 REPORT OF THE COMMITTEE OF THE PLANNING FOR NUCLEAR POWER UTILIZATION AND DEVELOPMENT. Genshiryoku Chosa Jiho; No. 26, (Jan 1975). (In Japanese).

Japan Atomic Industrial Forum had set up a Committee of the Planning for Nuclear Power Utilization and Development in March 1974, to study the scheme of nuclear power generation in the country and the problems involved in it with a view to establishing firmly the nuclear power generation in the overall national economy. The committee was composed of five subcommittees on general aspects, siting including also safety, environment and wastes, nuclear fuel such as fuel cycle, and technology/development in personnel, industrial capability and technology, respectively. The results of studies by each subcommittee, extending over six months, are presented. (JA)

21748 HOW FAR NUCLEAR POWER GENERATION IS ABLE TO CONTRIBUTE. Takei, M. (Japan Energy Economic Research Inst., Tokyo). Tokyo, Japan; Japan Energy Economic Research Inst. (1975). 75p. (In Japanese).

The extent that nuclear power generation will be able to contribute to overall energy sources is analyzed. The results of a survey made in this connection are presented in the following chapters: economy of the nuclear power generation; limitations in the supplies of nuclear fuels such as uranium concentrate and enriched uranium; electric power, fuel supply and nuclear power generation; development of nuclear power generation in the U. S.; calculation of the environmental radiation in nuclear power generation. (JA)

Reactor Fuel Cycle Economics

21749 DEPENDENCE OF LONG-TERM FUEL DEMANDS ON REACTOR TYPE, (1). Effects of Plutonium Recycling and Plutonium Producing Reactors. Furuhashi, A. (Tokyo Univ. (Japan). Faculty of Engineering). Nippon Genshiryoku Gakkaishi; 16: No. 11, 582-590(Nov 1974). (In Japanese).

Material requirements in the long-term fuel cycle, such as the cumulative demand for natural U and for separative work are analyzed, assuming an anticipated growth-rate for nuclear generating capacity in Japan. The limitations inherent in a simple system consisting solely of light water reactors and fast breeders are discussed, and an examination is made on the effects brought by the introduction of Pu recycling and/or Pu producing reactors. It is shown that the Pu recycling reactors provide a short-term relief at the expense of long-term sufficiency of supply. This last item can be eased to appreciable extent by the introduction in parallel with fast breeders, of thermal converter reactors with high Pu producing rate. Considerations are presented on the strategic repartition of generating capacity according to reactor types. Estimations of fuel cycle costs are also given. (auth)

21750 DEPENDENCE OF LONG-TERM FUEL DEMANDS ON REACTOR TYPE. II. Effects of Fast Breeder Characteristics and Their Delayed Utilization. Furuhashi, A. (Tokyo Univ. (Japan). Nuclear Engineering Research Lab.). Nippon Genshiryoku Gakkaishi; 16: No. 12, 632-639(Dec 1974). (In Japanese).

Material requirements in the long-term fuel cycle, such as the cumulative demand for natural U and separative work, are analyzed under two different growth-rates anticipated for nuclear generating capacity in Japan. The analysis covers only a simple system consisting of light water reactors and fast breeders, but the breeding characteristics of the fast reactors are changed parametrically, and the timing of the first FBR installation also is varied in the range of 1986 to 1996 and beyond. The cumulative demand for natural U prior to attainment of the self-supporting Pu breeding cycle is empirically represented by a simple function of breeder characteristics. To give an indication of the possible fuel saving with a reduced projection of the nuclear installations, a typical case is analyzed, in which the anticipated capacity of such installations is toned down after the year 2000. The importance of the time delay in commencing re-use of discharged Pu is discussed. The delay exerts a large influence on the material requirements, if the installation capacity is assumed to grow rapidly. A simple consideration is presented concerning the limitation on the growth-rate of breeder capacity imposed as a result of this time delay. (auth)

Reactor Licensing and Regulation

Refer also to abstract 21454, 21679, and 21681.

21751 (EUR-5284e) AUTHORIZATION PROCEDURE FOR THE CONSTRUCTION AND OPERATION OF NUCLEAR INSTALLATIONS WITHIN THE EEC MEMBER STATES. (Didier (J. M.) and Associates, Brussels (Belgium)). 1974. 96p. Dep. NTIS (US Sales Only) $8.00. EUR B. Fr. 250,-.

For Belgium and Luxembourg, the authorization procedure varies according to the Class in which the installation concerned falls (assigned according to the degree of hazard involved: Classes I, II or III). Moreover, separate authorizations are needed, one for construction and another for operation of Class I and II installations. With respect to Germany also, two such separate authorizations are needed, but there is no specific procedure relating to the potential extent of hazard involved in the installation concerned. In France, the "basic" nuclear installations are subject to a special procedure. Furthermore, the construction and operation of these installations are also subject to two separate authorizations. While the latter two authorizations are required in Italy for the main nuclear installations, no system of "classified" installations exists according to extent of hazard involved. Similar legislation is applicable in the Netherlands. Neither does such a system of "classified" installations exist in the United Kindgom. Moreover, there is only one single authorization (the "site licence"), which is successively adapted during construction. On the other hand, in Denmark and Ireland, no detailed legislation has been developed on the subject. (auth)

21752 (IRS-A-7) INSTITUTIONS FOR THE FORMULATION AND PROMOTION OF NUCLEAR REGULATIONS. Schlegel, W. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e. V., Koeln (F. R. Germany)). Dec 1974. 124p. (In German). INIS.

A survey is presented on German, French, English, and North American as well as international institutions concerned with the establishment of nuclear energy rules and guides. (GE)

21753 (NP-20418) PROGRAM REPORT, Reactor Licensing and Safety. (Atomic Industrial Forum, Inc., New York (USA)). May 1975. 180p.

Separate abstracts were prepared for each of the 24 papers included. (JWR)

For abstracts of individual papers see: 21429, 21647–21658, and 21754–21764.

21754 (NP-20418, pp 2-7) GOOD GOVERNMENT. Muntzing, L. M. May 1975.

In Program Report, Reactor Licensing. (Atomic Industrial Forum, Inc., New York (USA)).

The role and obligations of the Nuclear Regulatory Commission in the licensing of nuclear power plants are discussed. (JWR)

21755 (NP-20418, pp 8-14) INTRODUCTION AND OVERVIEW OF CURRENT DIRECTIONS IN REGULATORY PRACTICE. Ward, J. E. May 1975.

In Program Report, Reactor Licensing. (Atomic Industrial Forum, Inc., New York (USA)).

The licensing and regulatory situation for nuclear power plants is reviewed. (JWR)

21756 (NP-20418, pp 15-27) IMPLEMENTATION OF STANDARD REVIEW PLANS. Schroeder, F. May 1975.

In Program Report, Reactor Licensing. (Atomic Industrial Forum, Inc., New York (USA)).

The intent, scope, and implementation of standard review plans for Safety Analysis Reports are discussed. (JWR)

21757 (NP-20418, pp 28-30) APPLICANT'S LOOK AT LICENSING AND SCHEDULING. Bartnoff, S. May 1975.

In Program Report, Reactor Licensing. (Atomic Industrial Forum, Inc., New York (USA)).

The viewpoint of utilities concerning reactor licensing and scheduling is presented. (JWR)

21758 (NP-20418, pp 31-35) REGULATORY-INDUSTRY INTERFACE IN STANDARDS DEVELOPMENT. Minogue, R. B. May 1975.

In Program Report, Reactor Licensing. (Atomic Industrial Forum, Inc., New York (USA)).

The roles of industry and the Regulatory Staff in the development of nuclear standards are reviewed. (JWR)

21759 (NP-20418, pp 36-40) PROGRESS TOWARD THE STANDARDIZATION OF NUCLEAR POWER PLANTS. Giambusso, A. May 1975.

In Program Report. Reactor Licensing. (Atomic Industrial Forum, Inc., New York (USA)).

The current status of the standardization of nuclear power plants is surveyed. (JWR)

21760 (NP-20418, pp 41-44) UTILITY EVALUATION OF THE STANDARDIZATION OPTIONS. Van Brunt, E. E. Jr. May 1975.

In Program Report. Reactor Licensing. (Atomic Industrial Forum, Inc., New York (USA)).

The procedural options for the processing of standardized designs of nuclear power plants are reviewed. The advantages to utilities in choosing duplicate standard units are discussed. (JWR)

21761 (NP-20418, pp 45-52) VENDOR PERSPECTIVE ON IMPLEMENTATION OF STANDARD OPTIONS. Salvatori, R. May 1975.

In Program Report. Reactor Licensing. (Atomic Industrial Forum, Inc., New York (USA)).

Steps necessary to reduce the long licensing and construction times for nuclear power plants are discussed. The role of plant standardization in reducing the lead time is examined. (JWR)

21762 (NP-20418, pp 53-59) STANDARDIZATION REPLICATION AND THE REFERENCE PLANT OPTION. Oslick, H. May 1975.

In Program Report. Reactor Licensing. (Atomic Industrial Forum, Inc., New York (USA)).

The reference plant and duplicate plant options for standardized nuclear power plants are discussed. Aspects examined include financial implications of standardization, escalation of plant safety criteria, potential anti-competitive features, variations of site safety parameters, impact of the environmental review process, and filing fees. (JWR)

21763 (NP-20418, pp 60-62) PATHWAYS TOWARD ACHIEVING PRE-DESIGNATED SITING. Thomas, R. A. May 1975.

In program report. Reactor licensing. (Atomic Industrial Forum, Inc., New York (USA)).

Some advantages and disadvantages of decoupling reactor sites and plants for licensing purposes are discussed. Some problems which must be solved to make pre-designated siting practical are reviewed. (JWR)

21764 (NP-20418, pp 123-129) STANDARDIZED TECHNICAL SPECIFICATIONS. Szczepanski, F. A. (Tennessee Valley Authority, Chattanooga). May 1975.

In program report. Reactor licensing. (Atomic Industrial Forum, Inc., New York (USA)).

The development and implementation of a standardized format for technical specifications of nuclear power plants are reviewed. (JWR)

21765 (NRCI-75/3) NUCLEAR REGULATORY COMMISSION ISSUANCES, MARCH 1975. (Energy Research and Development Administration, Oak Ridge, Tenn. (USA). Technical Information Center). Apr 1975. 120p. TIC $2.50.

Reactor licensing actions taken by the Nuclear Regulatory Commission, the Atomic Safety and Licensing Appeal Board and the Atomic Safety and Licensing Boards for March 1975 are presented. Action was included for the following reactors: Big Rock Point Nuclear Plant; West Valley Reprocessing Plant; Limerick Generating Station, Units 1 and 2; Midland Plants, Units 1 and 2; Wolf Creek Generating Station, Unit 1; Monticello Nuclear Generating Plant, Unit 1; Douglas Point Nuclear Generating Station, Units 1 and 2; Seabrook Station, Units 1 and 2; Vermont Yankee Nuclear Power Station; and WPPSS Hanford Units 1 and 4. (PCS)

21766 (NUREG/PRDI-75/8) POWER REACTOR DOCKET INFORMATION. (Nuclear Regulatory Commission, Washington, D. C. (USA)). Aug 1975. 81p. TIC $1.85.

Citations and subject indexing to the documentation associated with civilian nuclear power plants are presented. This material is that which is submitted to the U. S. Nuclear Regulatory Commission support of applications for construction and operating licenses. Citations are listed by Docket number in accession number sequence. The Table of Contents is arranged both by Docket number and by nuclear power plant name. (DCC)

21767 (REG/G-1.14(Rev.1)(8-75)) REACTOR COOLANT PUMP FLYWHEEL INTEGRITY. (Nuclear Regulatory Commission, Washington, D.C. (USA). Office of Standards Development). Aug 1975. 4p. NRC.

21768 COMPARISON OF NUCLEAR LEGISLATION WITH RESPECT TO NUCLEAR INSTALLATIONS. de los Santos Lasurtegui, A.; Tocino Biscarolasaga, I. Energ. Nucl. (Madrid); 18: No. 91, 309-313(1974). (In Spanish).

The legislation governing the operation of nuclear power plants in Spain, the United States, and Italy is compared from the viewpoint of statutes, controlling authority, licencing regulations, control and inspection, and sanctions. (JSR)

21769 APPLICATIONS OF NUCLEAR SAFETY IN SPAIN. Alvarez de Buergo, L. Energ. Nucl. (Madrid); 18: No. 91, 315-320(1974). (In Spanish).

The 1964 law on nuclear energy and other statutes are briefly reviewed. The legislation on nuclear installations and installations using radiation is discussed in more detail, outling the steps for the authorization of reactor construction, provisional operation of a reactor, permanent operation, and inspection during construction and operation. (JSR)

21770 RICHTLINIEN FUER DAS EINLEITEN RADIOAKTIVER STOFFE AUS KERNTECHNISCHEN ANLAGEN IN DIE GEWAESSER. (Regulations for the Introduction of Radioactive Materials from Nuclear Facilities into Waters). Mainz; Laenderarbeitsgemeinschaft Wasser (1974). 8p. (In German).

1 fig.; 1 tab.

The rivers in the German Federal Republic more and more serve in cooling of nuclear facilities. To get uniform regulations concerning the diversion of radioactive waste waters, different rules and laws must be regarded. From these rules the conditions for waste water diversion and the necessary controls can be deduced. (GE)

GENERAL AND MISCELLANEOUS

Energy Utilization and Economics

21771 WAYS OF SECURING THE ENERGY SUPPLY. Mandel, H. (Rheinisch-Westfaelisches Elektrizitaetswerk A. G., Essen (F. R. Germany)). Energiewirtsch. Tagesfragen.; 25: No. 3, 71-79(Mar 1975). (In German).

From 2nd workshop on nuclear energy of the RWE; Walldorf, F. R. Germany (6 Nov 1974). 16 figs.

After an estimation of the supply of primary energy with regard to its geographical distribution, a forecast on the expected development of primary energy consumption and electricity supply of the German Federal Republic in the year 2000 is attempted. Percentages and costs of nuclear energy are particularly emphasized in comparative evaluations. (GE)

Information Handling

21772 (AECL-5002/40) LIST OF PUBLICATIONS, APRIL 1974 TO MARCH 1975. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Apr 1975. 33p. Dep. NTIS (US Sales Only) $4.75.

The publications are listed in the following broad categories: general; life sciences; chemistry; engineering; earth sciences; electronics, instruments and devices; metals, ceramics and other materials; mathematics and computer programs; physics; and reactor technology. Author, report number, and AECL number indexes are included. (MCG)

21773 (EUR-5177) REPORT ON THE ACTIVITIES OF THE COMMITTEE FOR INFORMATION AND DOCUMENTATION ON SCIENCE AND TECHNOLOGY (CIDST) OF THE EUROPEAN COMMUNITIES FOR 1972 AND 1973. (Commission of the European Communities, Luxembourg). 1974. 22p. Dep. NTIS (US Sales Only) $4.25. EUR B.Fr. 40.-.

The CIDST was set up by a Resolution of the Council of Ministers dated 24 June 1971 in order to encourage progress in scientific and technical information and documentation and gradually to establish a European documentation and information network by the proper coordination of Member States policies and activities in this field. This is the first annual report of the CIDST, reviewing its activities during 1972 and 1973. The report is in five sections. Section 1 describes the beginnings of the CIDST; section 2 deals briefly with general matters. Sections 3 and 4 cover the actual work of the CIDST, section 3 being devoted to the activities of the Committee itself and section 4 to those of its working groups. Section 5 sets down the report's conclusions and prospects for the future. (auth)

21774 (JINR-P10-8622) SEARCH STRATEGY IN THE JINR INFORMATION RETRIEVAL SYSTEM. Arnaudov, D. D. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 27p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

A created information search strategy in a projected JINR IRS is considered, as well as a constructed variant of a three-level search in a descriptoral type system and a realized user feedback. (1 figure, 3 tables) (auth)

21775 (ORNL-4951(Rev.1)) ON-LINE CONVERSATIONAL RETRIEVAL SYSTEM FOR ORCHIS TEXT-ORIENTED DATA BASES: USER'S MANUAL. Singletary, V. A. (Oak Ridge National Lab., Tenn. (USA)). May 1975. Contract W-7405-eng-26. 72p. Dep. NTIS $5.45.

This report is a user guide to the ORLOOK computer program. It includes descriptions of information files, methods of communication, program functions, control command syntax, and frequently used terminology. The program was developed as an integral part of the Oak Ridge Computerized Hierarchical Information System (ORCHIS) to facilitate retrospective searches of online linear files. It executes in the timesharing teleprocessing environment of the IBM 360 Model 75 computer at the Oak Ridge National Laboratory. Subset files produced from its logical operations can be searched, combined, copied to online storage for subsequent ORCHIS manipulation, and transmitted to the user typewriter terminals or to the computer system printer for output. (7 figures) (auth)

21776 (PEL-241) SELECTIVE DISSEMINATION OF INFORMATION WITH SPECIAL REFERENCE TO SA/INIS/SDI. Butterly, E. (Atomic Energy Board, Pelindaba, Pretoria (South Africa)). Oct 1974. 115p. Dep. NTIS (US Sales Only) $8.75.

SA/INIS/SDI is described with reference to its three basic components: the data base, the program, and the users. The effectiveness of the manner of profile construction and the service offered were evaluated using recall and precision ratios as retrieval measures. It was concluded that a simple approach to the construction of profiles was the most cost-effective. (MCG)

21777 (TID-26500R1) SUBJECT CATEGORIES USED IN NUCLEAR SCIENCE ABSTRACTS, 1967-1975. Whitson, M. O. (ed.). (Energy Research and Development Administration, Oak Ridge, Tenn. (USA). Technical Information Center). Jul 1975. 23p. Dep. NTIS $4.00.

A history of the changes that have occurred in Nuclear Science Abstracts subject categories and their corresponding tag numbers since 1967 is presented in tabular format. (MCG)

21778 (TID-26770) AN ANALYSIS OF WORLD-WIDE CONTRIBUTIONS TO NUCLEAR SCIENCE ABSTRACTS. Volumes 27 and 28(1973). Cape, J. D. (Energy Research and Development Administration, Oak Ridge, Tenn. (USA). Technical Information Center). Jun 1975. 77p. Dep. NTIS $5.45.

The literature appearing in Nuclear Science Abstracts (NSA) in 1973 is analyzed in 3 tables, 23 figures, and 2 appendixes. The analysis includes the total number of literature items contributed arranged by country of author affiliation and broken down into type of literature; the number of items in each NSA subject category contributed by each major contributing country of author affiliation; bar charts showing the growth of NSA and NSA categories over the years; the number and percent of items in each NSA category contributed by the major contributors; bar charts comparing major country contributions to NSA; and lists of journals with the number of items appearing in NSA arranged by country of journal publication and in order of decreasing number of items. (auth)

Law

Refer also to abstract 21367.

Management

21779 (ERDA-41) WASH/ERDA REPORT INDEX. WASH and ERDA Reports Listed by Number, Key-word-out-of-context (KWOC) Index to Report Titles. (Energy Research and Development Administration, Washington, D.C. (USA). Div. of Administrative Services). Jul 1975. 187p. Dep. NTIS $7.60.

This index contains a listing of all unclassified AEC reports starting with WASH 1100 and unclassified ERDA reports through May 22, 1975 (ERDA 1-ERDA 42); it also includes a KWOC index to the approximately 1200 "key words" which appear in the WASH and ERDA report titles. The WASH series consists of administrative, scientific, and technical reports issued by the USAEC. This series closed when the AEC was abolished. The Energy R and D Administration then began an "ERDA" series. Certain WASH reports continue as ERDA reports. (RWR)

21780 (INIS-mf-1776) THE SWISS INSTITUTE FOR NUCLEAR RESEARCH, VILLIGEN. A National Research Centre. (Schweizerisches Inst. fuer Nuklearforschung, Villigen). 1973. 29p. (In German). INIS.

After a short introduction to elementary particle physics the technical and experimental installations of the Swiss Institute for Nuclear Research at Villigen are described. The main installations are an isochronous cyclotron and an isochronous ring accelerator. If interconnected one to the other, they are able to produce protons of 600 MeV at 100 μA. This proton beam is used for the generation of π and μ mesons, enabling various investigations in the field of nuclear and atomic physics as well as in biology and medicine. (INIS)

21781 (NP-20387) ANNUAL REPORT OF THE DEPARTMENT OF ATOMIC ENERGY, 1974-1975. (Department of Atomic Energy, Bombay (India)). 1975. 176p. Dep. NTIS (US Sales Only) $12.00.

This report gives an account of: the atomic energy establishments in India; the underground nuclear explosion of May 18, 1974; Bhabha research; reactor research; atomic minerals; Tata research; Saha nuclear research; nuclear power; nuclear fuel complex; heavy water projects; industrial operations; etc. (DLC)

21782 (NP-20430) GUIDELINES FOR THE PROFESSIONAL EVALUATION OF THE PERSONNEL OF NUCLEAR POWER PLANTS. (Bundesministerium des Innern, Bonn (F. R. Germany)). 8 Oct 1974. 13p. (In German). Dep. NTIS (US Sales Only) $4.00.

Since the operation of nuclear power plants requires personnel with professional qualifications, the German nuclear law specifies the qualifications necessary for different classifications of jobs.

The procedures for the evaluation of professional personnel under this law are outlined. (JSR)

21783 (NP-20486) JAPAN ATOMIC ENERGY RESEARCH INSTITUTE ANNUAL REPORT AND ACCOUNTS, 1973/1974. (Japan Atomic Energy Research Inst., Tokyo). 1974. 42p. Dep. NTIS (US Sales Only) $5.25.

Research progress is reported on the light-water reactor under construction as a commercial power plant, the advanced thermal reactor, the sodium-cooled fast breeder reactor, the multi-purpose high-temperature gas-cooled reactor that is to be utilized for nuclear heat process, the gas-cooled fast breeder reactor, and the nuclear fusion reactor. The multi-purpose high-temperature gas-cooled reactor is expected to be the energy source of steel-making and other major industries. Safety research was advanced with the creation of programs for the simulated Loss of Coolant Accident Experiments for light water reactors (ROSA Project), experiments on the reactivity accidents (NSRR Project), and for fuel safety concerns. Research on the treatment of radioactive wastes is reported. Research on the utilization of radiation is reported for radiation improvement of plastics, food irradiation, and air and water pollution surveys. Radioisotope production and separation processes are reported. A large-scale uranium hexafluoride recycle loop for uranium enrichment research, the success of double fluorine for dry volatility reprocessing, and the synthetic detection of Californium-252 are reported. International cooperation, educational aspects, and general administration for the research center are summarized. (MCW)

21784 (TID-26793) 1974 ANNUAL REPORT TO CONGRESS. Part One: Operating and Developmental Functions. Part Two: Regulatory Functions. (USAEC, Washington, D. C.). 1974. 253p. Dep. NTIS $7.60.

This report is of a nontechnical nature, with numerous photographs. The first part contains chapters on the reorganization of the AEC to ERDA and NRC, the history of the AEC: 1946–1975, energy research and development, breeder reactors, public health and safety, fusion research, environmental research, biomedical research, physical research, nuclear materials, national security, and management of radioactive waste. The part on regulatory functions contains chapters on nuclear regulation in 1974, 1974 nuclear power licensing, fuels and materials licensing, nuclear materials and plant protection, regulatory operations, nuclear standards development, public participation in regulation, and state and international liaison. Appendixes give membership of various boards and committees, changes in rules and regulations, a list of AEC regulatory guides, and a table of nuclear electric generating units in operation, under construction, or planned. (RWR)

21785 TO CONSIDER NATO MATTERS. Hearings Before the Joint Committee on Atomic Energy, Congress of the United States, Ninety-Third Congress, Second Session, February 19, 1974. Washington, DC; Joint Committee on Atomic Energy (1975). 31p. GPO.

The hearings were carried out with General A. J. Goodpastor, U. S. Commander-In-Chief, Europe, U. S. European Command as principal witness. Subjects discussed were nuclear weapons capability and security in Europe, the NATO alliance, the proposed artillery-fired atomic projectile and atomic demolition munitions, and the possibility of war in Europe. (DLC)

21786 CURRENT MEMBERSHIP OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, JOINT COMMITTEE ON ATOMIC ENERGY MEMBERSHIP, PUBLICATIONS, AND OTHER PERTINENT INFORMATION THROUGH THE NINETY-THIRD CONGRESS, SECOND SESSION, JOINT COMMITTEE PRINT, NINETY-FOURTH CONGRESS, FIRST SESSION, APRIL 1975. Washington, DC; Joint Committee on Atomic Energy (1975). 80p. GPO.

This pamphlet includes a list of unclassified publications issued by the Joint Committee, descriptions of atomic energy legislation enacted since 1946, a list of legislative reports, tabulation of committee reports on agreements for cooperation; locations of ERDA depository libraries in USA and abroad; tables tracing the membership of the committee and of AEC, ERDA, and NRC; a table of the length of member service on the committee and subcommittee; a statement of the committee organization and functions; and the most recent report to Congress. (DLC)

21787 PHYSICS RESEARCH AT HARWELL. Marshall, W. (United Kingdom Atomic Energy Authority, Harwell, Eng.). Phys. Technol.; 6: No. 3, 103-108(May 1975).

The recent changes in the research programme at Harwell are outlined, the aims and objectives of the laboratory are summarized, the problems involved in making a major reorientation in the research programme are described, and all these points are illustrated with examples concerned primarily with physics research. Finally, the article describes how the physics work of Harwell is likely to evolve over the next decade. (UK)

Mathematics and Computers

Refer also to abstracts 20009, 20026, and 21775.

21788 (ANL-8153, pp 175-177) CENTRAL REAL-TIME COMPUTER FACILITY. Day, P. P.; Hines, J. J.; Zielen, A. J. Jan 1975.

In Chemistry Division annual report, July 1973–June 1974. (Argonne National Lab., Ill. (USA)).

The computer facility of the ANL Chemistry Division is described. A central facility providing all real-time support, the system provides each on-line experimentalist with all the advantages of a moderate-sized computer while also providing the isolation enjoyed by individually dedicated minicomputer systems. The system contains 56K works of core, 75 Mbytes of disk storage, an on-line plotter, two nine-track tape drives, high-speed line printer, card reader, card punch, and paper tape reader–punch. The 24 on-line experiments using the system are tabulated. (1 table) (RWR)

21789 (BNL-20337) BRAGG REFLECTION PROGRAM. Lynn, J. W. (Brookhaven National Lab., Upton, N. Y. (USA)). [nd]. 15p. Dep. NTIS $4.00.

This user's guide to the Bragg Reflection Program (BRP) is in the nature of an informal report. The general purpose of BRP is to scan a series of Bragg reflections automatically in order to obtain profiles and integrated intensities. The program is used in conjunction with the SUPERVISOR and READ packages, and the procedures for using it are similar to those for the Triple-Axis Control program. All the general features of the system, SUPERVISOR and READ packages as described in the Spectrometer Control Systems User's Guide are preserved. The presentation assumes that the reader is familiar with these. Sections are given on the READ package, execution and use, error messages, and output. A few sample problems are shown. (1 figure) (RWR)

21790 (CEA-N-1778) AN ON-LINE REAL TIME SPIKE RECOGNITION SYSTEM IN MULTIPLE UNIT EXTRACELLULAR RECORDS. Dupoirier, F. (CEA Centre d'Etudes Nucleaires de Saclay, 91–Gif-sur-Yvette (France). Services d'Electronique). Dec 1974. 75p. (In French). Dep. NTIS (US Sales Only) $6.75.

Thesis.

An on-line real time spike recognition and separation system for up to nine different spikes in multiple unit extracellular records was developed which consists of a minicomputer and a special recognition device. This device works on a grammatical analysis of the raw signal. After a recognition of each spike, the device extracts and supplies the computer with the characteristic parameters of the spikes. Thus, the spike recognition system is divided in two parts: the special recognition device providing the signal analysis, and the original computer, which has now only to work on the spike classification problems. Two classification methods are shown. (37 figures, 2 tables) (auth)

21791 (CEA-N-1792) DEVELOPMENT OF THE PDP8 BASIC PROGRAMMING LANGUAGE FOR THE USE OF CAMAC UNITS. Nguyen, K. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Services d'Electronique). 30 Jan 1975. 36p. (In French). (CEA-SES-PUB-SEG-74-126). INIS.

The programming language BASIC is one of the simplest computer languages to learn. It is used in many automatic measurement systems. In the described application, this language is used to transfer data between a mini-computer and the "CAMAC" standard. The functions which assume the data transfer (read, write, etc.) are written in assembly language. (FR)

21792 (COO-2487-1) FEASIBILITY STUDY OF A COLLABORATION BETWEEN THE LABORATORY FOR NUCLEAR SCIENCE AND THE INFORMATION PROCESSING CENTER AT MIT IN JOINING THE ARPA NETWORK. Progress Report, July 15, 1974–July 14, 1975. Baumel, H.; Campbell, E. J. (Massachusetts Inst. of Tech., Cambridge (USA)). 1975. Contract AT(11-1)-2487. 62p. Dep. NTIS $6.25.

The Laboratory for Nuclear Science, the Information Processing Center, and the Programming Development Office at MIT are conducting a feasibility study of a collaborative effort in joining the ARPA network. The part of the study dealing with methods of implementations essentually has been completed, and a viable method for both LNS and IPC has been selected. For financial reasons the implementation has been postponed until FY 77. During FY76, the experiments begun in this study are scheduled to be continued and expanded to include multiple computer problems. Five options for implementing an ARPA network connection are presented, accompanied by the advantages and disadvantages of each option. Experiments performed to date, using the Multics system for access to the ARPA network, are described; and the

economic and human user considerations are discussed. In these experiments, the remote computer providing services was the 360/91 at UCLA. Files were transferred between UCLA and MIT, technical documents and project correspondences were sent via network mail, and timesharing on the UCLA computer was accessed via the network from a terminal at MIT. The short-term network access plan using the Multics timesharing system is suggested; and a longer term implementation using a mini-computer programmed to access the network and act as an interface for other MIT computers and terminals is further suggested. Since the packet switching technology is currently reaching the commercial marketplace, it must be further considered as a possible solution to the networking needs of LNS and MIT in the future. An expanded program of experiments is required to determine the optimum use of networks by both LNS and MIT. To date, the network study has proven so beneficial to both groups as to warrant its continuation. (auth)

21793 (IS-T-675) ITERATIVE METHOD FOR FREDHOLM EQUATIONS OF THE FIRST KIND. Peterson, W. C. (Ames Lab., Iowa (USA)). May 1975. Contract W-7405-eng-82. 115p. Dep. NTIS $8.75.

Thesis.

An iterative method is developed to find an approximation to the least squares solution of minimum norm, f_0, of an operator equation, Kf equals g, of the first kind. In applications to integral equations, the superfluous oscillations in the final solution of methods in the literature are not an apparent problem. Letting K: H_1 yields H_2 be a completely continuous operator from a real separable Hilbert space H_1 to a real Hilbert space H_2, a sequence converging to f_0 is constructed, and stability and error bounds are obtained. (1 figure, 2 tables, 25 references) (auth)

21794 (LBL-3655) DESIGN TOOLS FOR DATA HANDLING SYSTEMS. Ringland, G. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 31 Jan 1975. Contract W-7405-eng-48. 18p. (CONF-750229-2). Dep. NTIS $4.00.

From association for computing machinery conference; Washington, District of Columbia, USA (18 Feb 1975).

Complex data bases are now routinely accessed on line. Proper design of access procedures is vital to insuring the security of the data and that it can be recovered if necessary. The design tools discussed enable operator procedures to be charted in a way that identifies the interrelation between system recovery points and message sequences. Also described are the lower-level charts (flowcharts to describe interactive processing) used as specification for programs to be executed between recovery points. Examples are given from an order entry application. This is representative of applications which are primarily data entry and without the multitude of branching options encountered in some retrieval systems. (7 figures) (auth)

21795 (LBL-3659) DATA STRUCTURE CHARTING METHODS. Hart, E.; Ringland, G. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 31 Jan 1975. Contract W-7405-eng-48. 17p. (CONF-750229-1). Dep. NTIS $4.00.

From association for computing machinery conference; Washington, District of Columbia, USA (18 Feb 1975).

The growing importance of data base implementations, and the consequent need for describing interrelations between data elements, has highlighted the lack of tools for describing data structures. The paper describes, with examples, a charting method which has been used successfully on a number of large projects. The important features are the compactness of charting methods, which enables large and complex structures to be understood, and the ability to represent also detailed structures such as the sequencing of items (occurrences) within a data element (or description). (5 figures) (auth)

21796 (LBL-3801) SOFTWARE IN RESOURCE SHARING: SCIENTIFIC. Stevens, D. F. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Mar 1975. Contract W-7405-ENG-48. 10p. (CONF-750342-2). Dep. NTIS $4.00.

From 12th atomic energy systems, operations and programming association conference; St. Petersburg Beach, Florida, USA (25 Mar 1975).

Software is defined to be everything but hardware; it includes programming, documentation, and people. The problem addressed is the simultaneous usage of and access to the computer system by several agencies, whether locally resident or geographically scattered, and how this affects the programming, documentation, and people using and maintaining a wide-open establishment. It is concluded that there are no hidden technical software problems to be encountered in resource sharing in such an environment. (RWR)

21797 (LBL-3807) BUSINESS AND SCIENTIFIC COMPUTING: A PEACEFUL COEXISTENCE. Harvey, R. J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 18 Oct 1974. Contract W-7405-eng-48. 9p. (CONF-741041-3). Dep. NTIS $4.00.

From conference on atomic energy systems, operations, and programming focus on management issues; Bethesda, Maryland, USA (23 Oct 1974).

It is assumed in this paper that both business and scientific computing share the same computer hardware. Areas where business and scientific computing have conflicted, such as peak loads, security and data integrity, operational conflicts, software operating systems, and hardware needs are pointed out; and a new, possibly unsettling situation, management controls over computer resources, is introduced. Some promising developments are noted, and a suggested key to realizing peaceful coexistence is set forth. (RWR)

21798 (LBL-3808) EXPERIENCES IN RESOURCE SHARING. Harvey, R. J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 20 Mar 1975. Contract W-7405-ENG-48. 13p. (CONF-750342-1). Dep. NTIS $4.00.

From 12th atomic energy systems, operations and programming association conference; St. Petersburg Beach, Florida, USA (25 Mar 1975).

The sharing experiences at the Lawrence Berkeley Laboratory in the Mathematics and Computing Division are described. Its historical development, the organizational structure and the computing hardware presently installed, and some budgetary criteria are followed. (MCW)

21799 (ORNL-4961) GENERALIZED LEAST-SQUARES PROGRAM FOR USE ON A REMOTE TERMINAL. Sweeton, F. H. (Oak Ridge National Lab., Tenn. (USA)). May 1975. Contract W-7405-eng-26. 51p. Dep. NTIS $5.45.

The Busing and Levy generalized least-squares program ORGLS was modified for use on a remote terminal connected to the Laboratory's PDP-10 time-sharing computer. The program is written in an interactive mode so that the user enters the required data following step-by-step instructions printed on the terminal. The program can handle up to 50 experimental observations, each consisting of one dependent variable plus up to six independent variables. As many as 20 parameters can be used in the fitting function; up to six of these can be adjusted simultaneously. The user furnishes a small subprogram in which the dependent variable can be calculated from the independent variables using the fitting function being tested. The program is especially adapted for use by people with a minimum knowledge of computers who want quick answers to relatively small curve-fitting problems. (auth)

21800 (RT/EDP-(74)7) PROGRAM FOR THE ESTIMATION OF PARAMETERS IN MIXED LINEAR–NONLINEAR MODELS. Cesari, F.; Corradi, C. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Nov 1974. 31p. (In Italian). Dep. NTIS (US Sales Only) $4.75.

A FORTRAN program is described for least-squares estimation of nonlinear parameters when some of the parameters are linear. Some numerical results are presented. (auth)

21801 (SAND-74-5479) DISTRIBUTED COMPUTING SYSTEMS AND THE TESTING LABORATORY. Rathke, T. S. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 11p. (CONF-750502-3). Dep. NTIS $4.00.

From 21st International Instrument Society of American Symposium; Philadelphia, Pennsylvania, USA (19 May 1975).

In the testing laboratory the minicomputer has gone from the dedicated, one-task system to the real-time multiprogram system, and presently to the distributed multicomputer system. Small sensor-based dedicated terminal computers sharing the resources of a central computer make the distributed minicomputer system economically appealing. The problem of attaching a dedicated satellite minicomputer to the distributed network is developed with emphasis given to the economics of the system. Also, the problem of determining the proper communication link between the central computer and geographically dispersed satellites is developed with cases given for both hardwired and modem links. The distributed network configuration, resources allocation, communications link consideration, and system advantages are considered with specific examples as illustrations. (3 figures, 1 table) (auth)

21802 (SAND-75-5379) STATISTICAL METHOD FOR TEST SEQUENCE EVALUATION. Case, G. R. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1975. 10p. (CONF-750613-1). Dep. NTIS $4.00.

21803 SU-326-P18X7) SYSTEMS OPTIMIZATION PROJECT. Progress Report, 1 October 1973–30 July 1974. Dantzig, G. B.; Cottle, R. W.; Eaves, B. C.; Wilson, R. B. (Stanford Univ., Calif. (USA). Dept. of Operations Research). [nd]. Contract AT(04-3)-326. 15p. Dep. NTIS $4.00.

Brief summaries are given of computational work and software development: structured linear programing, general linear pro-

graming, quadratic programing and linear complementarity, and general nonlinear programing are included. Abstracts of technical reports are also presented. (RWR)

21804 (TID/SNA-1756) Kalman Filtering. Parziale, E. A. (Aerojet Nuclear Systems Co., Sacramento, Calif. (USA)). 10 Aug 1971. 9p. Dep. NTIS $4.00.

The recursive Kalman filtering equations were developed for discrete time linear systems corrupted with white gaussian noise. The assumptions and essential results for the discrete data version of the least squares Kalman filtering problem are presented. (1 diagram) (SDF)

21805 (UCLA-34P214-6) IMPLEMENTATION OF THE BURROUGHS D-MACHINE. Webster, F. C. (California Univ., Los Angeles (USA). Dept. of Computer Science). Jun 1974. Contract AT(04-3)-34. 101p. (UCLA-ENG-7449). Dep. NTIS $8.25.

The Variable Structure Computer research effort originally emphasized the design of special purpose hardware which could efficiently perform certain dedicated functions. Now the emphasis is on the development of a flexible processor system which can be reconfigured to conform to various special applications, much like an extensible language in the software realm. To enable experimentation in this area, a user-programable microprogramed processor was selected as a suitable test vehicle. An investigation into the field of microprograming and microprogramed computer systems resulted in the selection of the Burroughs D-Machine. Since the D-Machine is a prototype system and not a Burroughs product, only a generalized description of the processor and its programing system can be obtained from the manuals supplied by Burroughs Corporation. The purpose of this document is to provide an accurate description of the overall system which points out those characteristics which are unique to the UCLA implementation, and which clarifies points that are confusing or incomplete in the Burroughs manuals. (26 figures) (auth)

21806 (UCRL-76070) DIRECT DIGITAL CONTROL OF ELECTRODE POTENTIAL. Application to Controlled-Potential Electrolysis Experiments. Pomernacki, C. L.; Harrar, J. E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 7 Apr 1975. 66p. (CONF-750410-5). Dep. NTIS $6.50.

From 169th national meeting, American Chemical Society; Philadelphia, Pennsylvania, USA (6 Apr 1975).

A minicomputer program and electronic hardware were developed for controlling the potential of an electrode through the medium of an algorithm within the computer. The control algorithm found to be satisfactory is the discrete equivalent of proportional-plus-integral action. Control functions are carried out in assembly language at a sampling rate of 1 kHz; the parameters that govern the control action and electrolysis conditions can easily be changed on-line via a high-level conversational language. Theory was developed for guidance in tuning the controller for various electrolysis cell characteristics. Detailed control objectives and specifications were formulated for typical electrolysis experiments. The system was tested with mercury-pool and platinum working-electrode cells, demonstrating that the control objectives can be met and that the theory is useful. System risetimes of less than 8 ms can be achieved, and steady-state control errors are not significant. A major fraction of the time during each sampling period is available for other data processing. (14 figures, 1 table) (auth)

21807 (UCRL-76139) MATHEMATICAL ANALYSIS OF COMPUTATIONS REQUIRED TO ACCESS SECONDARY STORAGE DEVICES BY RANDOM METHODS AND SEQUENTIAL METHODS. Szabo, Szilard. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 23 Oct 1974. 9p. (CONF-741001-59). Dep. NTIS $4.00.

From CUBE symposium; Livermore, California, USA (23 Oct 1974).

Equations are derived for the time to access secondary storage devices using the direct random method and the sequential method. Parameters include data transfer rate, angular velocity of the disk, random average of the time of radial head motion, number of items referenced, buffer size, record size, and compaction factor. Cross-over points for the two equations are shown. (1 figure) (auth)

21808 (UNI-339) SLIDE LAYOUT AND INTEGRATED DESIGN (SLIDE) PROGRAM. Roberts, S. G. (United Nuclear Industries, Inc., Richland, Wash. (USA)). 19 Mar 1975. Contract AT(45-1)-1857. 27p. Dep. NTIS $4.50.

SLIDE is a FORTRAN IV program for producing 35 mm color slides on the Control Data CYBER-74. SLIDE interfaces with the graphics package, DISSPLA, on the CYBER-74. It was designed so that persons with no previous computer experience can easily and quickly generate their own textual 35 mm color slides for verbal presentations. SLIDE's features include seven different colors, five text sizes, ten tab positions, and two page sizes. As many slides as desired may be produced during any one run of the program. Each slide is designed to represent an 8½ in. x 11 in. or an 11 in. x 8½ in. page. The input data cards required to run the SLIDE program and the program output are described. Appendixes contain a sample program run showing input, output, and the resulting slides produced and a FORTRAN listing of the SLIDE program. (RWR)

Miscellaneous

21809 (ERA-75/5) ERDA RESEARCH ABSTRACTS. (Energy Research and Development Administration, Oak Ridge, Tenn. (USA). Technical Information Center). Jul 1975. 82p. TIC.

ERDA Research Abstracts (ERA) provides abstracting and indexing coverage of nonnuclear energy scientific and technical reports, patents, journal articles, conference papers, theses, and monographs originated by the United States Energy Research and Development Administration and its laboratories, energy centers, and contractors. It also covers reports from foreign governments with which ERDA has agreements for technical cooperation. This issue includes research done in the following areas: coal and coal products; oil shales and tar sands; hydrogen; solar energy; wind energy; electric power engineering; energy storage; energy management and conservation; energy conversion: advanced automotive propulsion systems; materials; chemistry; engineering; instrumentation; explosions and explosives; environmental sciences, atmospheric; environmental sciences, terrestrial; environmental sciences, aquatic; biomedical sciences, basic studies; biomedical sciences, applied studies; physics research; controlled thermonuclear research; and general and miscellaneous. (RWR)

21810 TECHNOLOGY TODAY AND TOMORROW. Proceedings of Eighth Space Congress, Cocoa Beach, Florida, April 19–23, 1971. Volume I. Stein, N. A. (comp. and ed.). Cocoa Beach; Canaveral Council of Technical Societies (1971). vp. (CONF-710410–P1). Canaveral Council of Technical Societies.

Volume I of the proceedings of the eighth space congress on technology, today and tomorrow contains the following sections: Advanced space programs; computer applications; meteorology; cryogenics in industry; oceanography; simulation and synthesis; mechanical systems; space logistics; launch vehicles; space communications; launch facilities and operations; management, education communications, and economic problems and solutions; maintainability and reliability; transportation; navigation satellites; and fluidics. (SDF)

Life Sciences

21811 (AD-784232) AIRBORNE FUNGAL SPORES IN NUCLEAR SUBMARINES. Doris, C. I.; Harper, M. G.; Morris, J. E. W. (Royal Naval Personnel Research Committee, London (UK)). Oct 1972. 12p. (SMS-7/72). NTIS $3.00.

The visible presence of fungal growth in certain areas of nuclear submarines has given rise to concern amongst the crews. The airborne spore population was investigated to determine the medical significance of such growths and the methods used are described. It is concluded that no medical hazards are associated with the presence of fungal growths, but that action is necessary to deal with the material deterioration caused by the growths. (GRA)

COMPLETE OR PARTIAL COLLECTIONS OF ERDA REPORTS IN COUNTRIES OTHER THAN THE UNITED STATES

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